The Electrical Industry's Weekly Magazine

March 27, 1961

Electrical World

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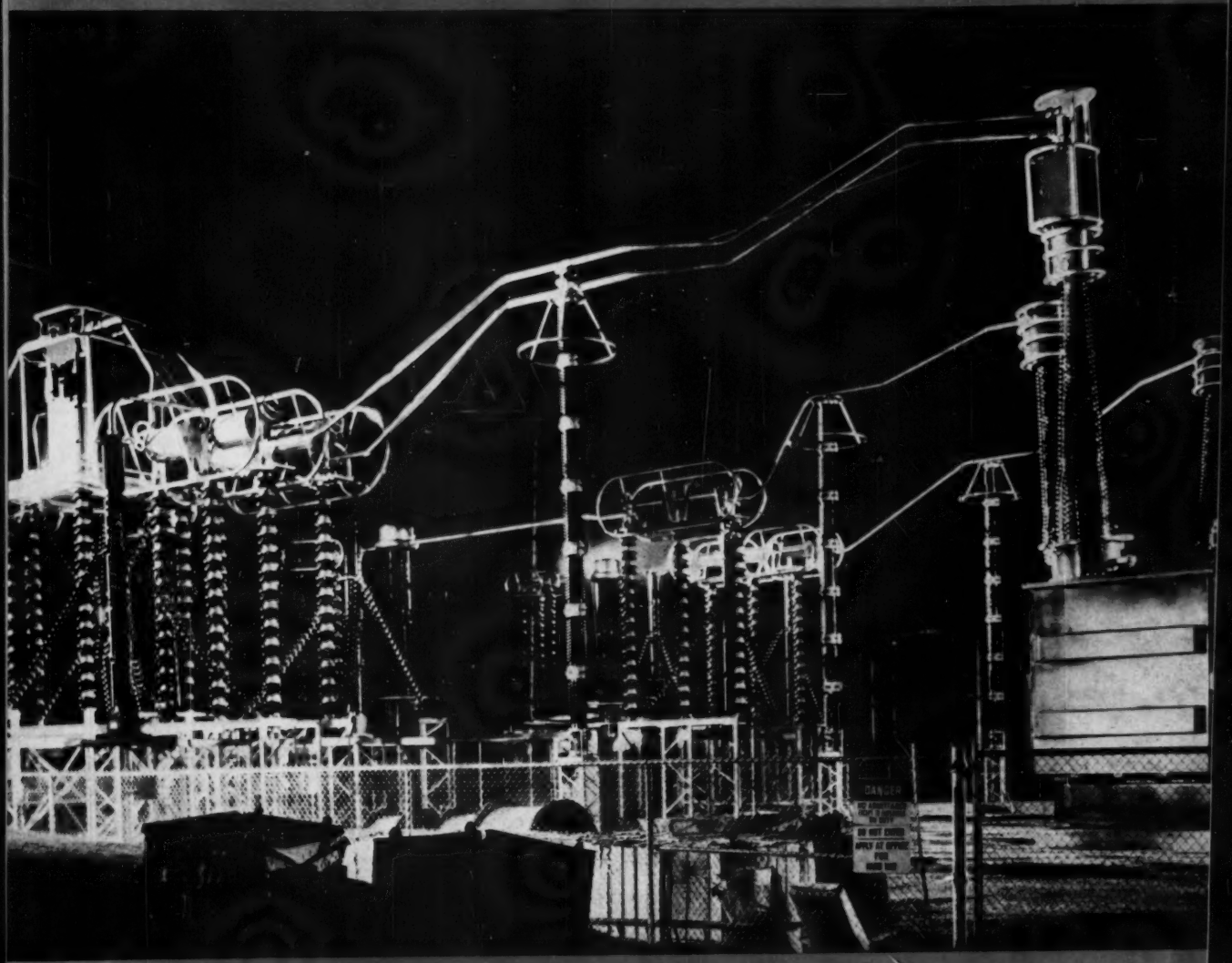

Insulation and Radio Influence Dictate Design of 650-Kv Substation...

...page 50

Federal Pumped-Storage Projects Brewing...pag

UNIV MICROFILMS INC GS
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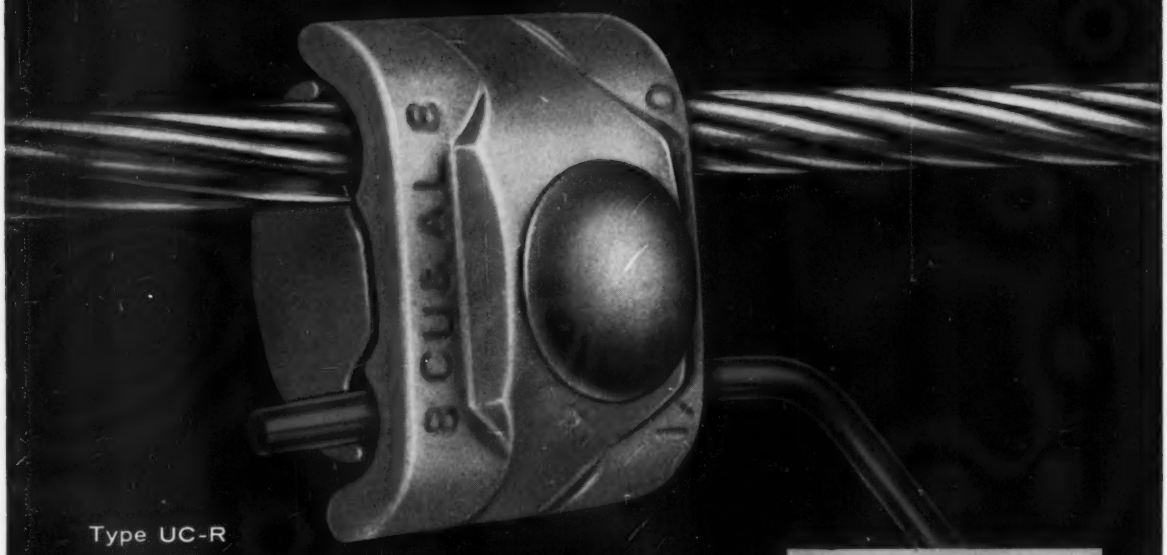
TAPIT

connects Aluminum to Copper...
*better... for 35% less**



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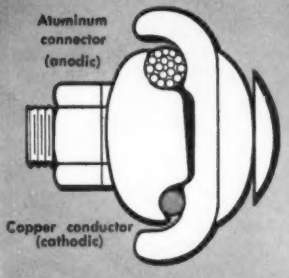

MASSIVE ALUMINUM TAPIT MINIMIZES CORROSION. The larger the mass of aluminum (anodic) compared to copper (cathodic), the less the galvanic corrosion in an aluminum-to-copper connection. Note massiveness of aluminum TAPIT connector in relation to copper conductor.

Field experience and extensive tests have proven that the massive aluminum TAPIT design withstands effects of galvanic corrosion better than copper-bushed or plated aluminum connectors on aluminum to copper conductor combinations.

*Massive aluminum design also... by eliminating need for copper bushings or special plating... saves at least 35% in cost of connectors for aluminum to copper.

Only five sizes required for joining any conductor combination in #8 thru 400 Mcm range. Stocking is simplified... TAPIT can also be used on aluminum to aluminum. Also available with PENETROX sealed in with STRIPSEAL.

Ask your Burndy representative how you can save 35% on aluminum to copper connections—and get better connections —or write directly to Burndy, Norwalk, Connect., or Toronto, Canada.

TAPIT®— *another engineered solution to your connector problems by*

BURNDY

58-12

Norwalk, Connect. In Europe: Antwerp, Belgium Toronto, Canada

Published for 87 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

Electrical World

MARCH 27, 1961

Vol. 155, No. 13

What in the Electrical World . . .

Next week this feature, "What in the Electrical World," bows out to make room for more pressing and more important material. This column was instituted some six months ago as a means of introducing new features and discussing some of our philosophy about the operation of *Electrical World*. We have had an opportunity to acquaint you with some of our behind-the-scenes action on our magazine.

But we have never labored under the illusion that discussions of our problems or our activity is more interesting or more useful to you than information about the utility industry.

Since this column was created a short six months ago, there have been many changes in our society and in our industry. A new national administration has come upon the scene. Numerous industry plans have been unveiled. A new sense of urgency is beginning to quicken the pace of the industry in several areas.

To keep you ahead of the game, we feel that we owe you a more penetrating report on the week's news. Instead of merely reporting the events, we want to dig deeply enough to uncover some of the plans for the months and years ahead.

One vehicle for our interpretative pieces has been the "Dateline" column appearing on page 5. Next week and the weeks thereafter you will be seeing the "Dateline" column in this space. We bow out in favor of material that we hope will be more directly useful to you.

Chuck Hochgesang

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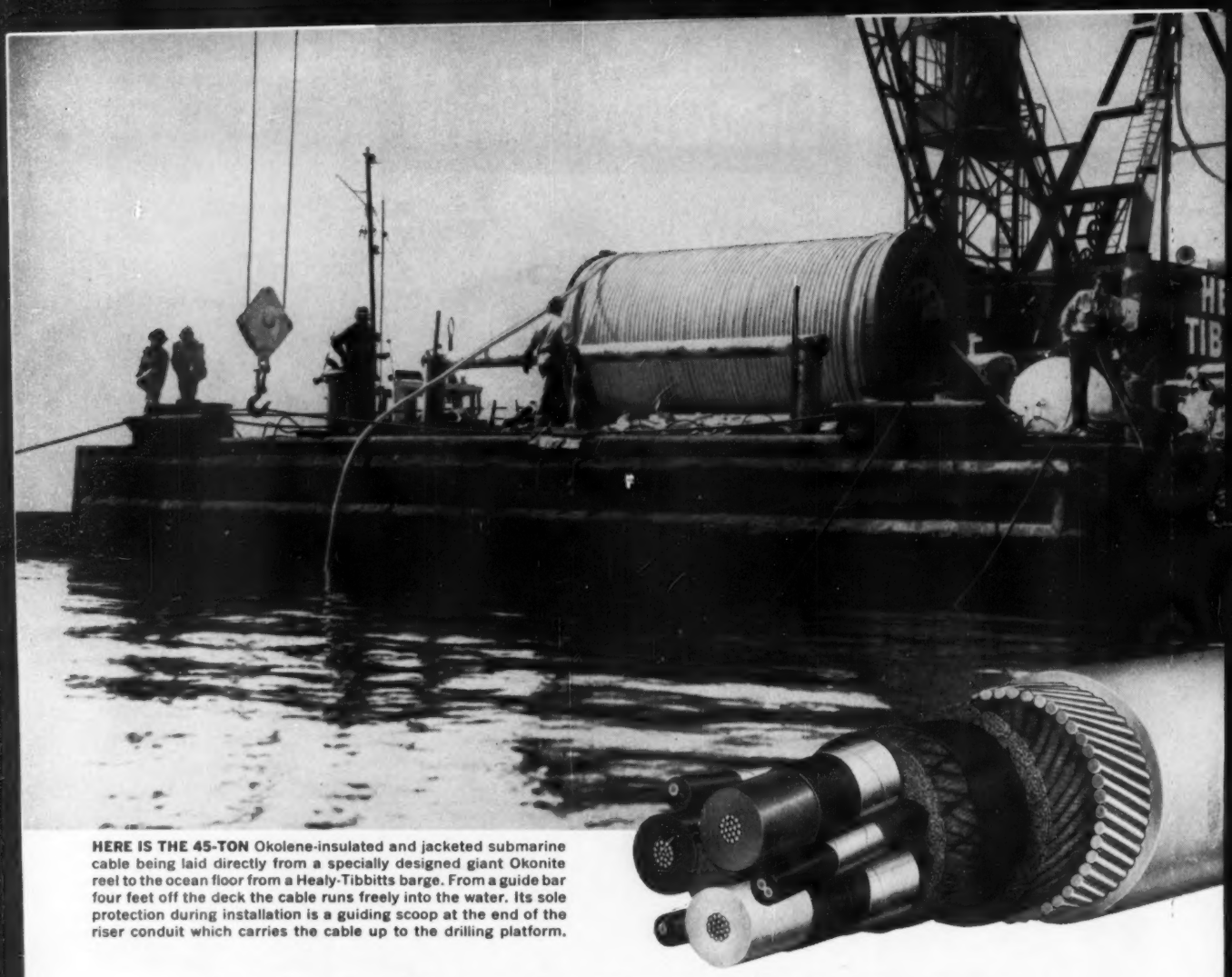

HERE IS THE 45-TON Okolene-insulated and jacketed submarine cable being laid directly from a specially designed giant Okonite reel to the ocean floor from a Healy-Tibbitts barge. From a guide bar four feet off the deck the cable runs freely into the water. Its sole protection during installation is a guiding scoop at the end of the riser conduit which carries the cable up to the drilling platform.

Unique Okonite 17kv polyethylene submarine cable goes to sea

Supplies power and control to a drilling rig located 2½ miles off the California coast.

An Okonite submarine cable—13,700 feet long, more than three inches in diameter, and weighing 45 tons—is carrying power and control circuits from the Southern California coast to a drilling platform 2½ miles off shore. This project is a joint venture of Standard Oil Company of California and Humble Oil and Refining Company.

Handling the historic job is a three conductor 17kv Okolene-insulated cable. This polyethylene insulation was selected because of its high dielectric strength and moisture resistance. Three color-coded, Okolene-insulated pairs are cabled with the power conductors to provide communications, alarm and remote control circuits.

Besides being subjected to all the standard testing procedures, this critical cable went through Okonite's patented Gooding Test Train, which electronically peered through every inch of the cable for flaws not found by normal test methods. This assured the customer the optimum in circuit security.

Standard of California has installed a second cable of this type and similar Okolene submarine cables are now serving other oil companies' off-shore drilling operations, including a number in the Gulf of Mexico.

These installations are just another example of how Okonite Cable'bility* helps solve unusual cable problems. Okonite can handle *your* requirements, too—both large and small—with job-designed cables—cables that assure you of safe, economical electrical power. An Okonite sales-engineer is always ready to be of technical assistance. Call him or write directly to The Okonite Company, Subsidiary of Kennecott Copper Corporation, Passaic, New Jersey.

*OKONITE Cable'bility . . . cable craftsmanship since 1878.

***where there's electrical power . . . there's* OKONITE CABLE**

7301

Electrical World

Letters

Peak Figures Were Wrong

To the Editor:

On page 38 of the Feb. 6 issue of *Electrical World* you published a tabulation of winter peak data. Please be informed that the listing for the Atlantic City Electric Co in the first, fourth, and fifth columns is incorrect or incomplete. These are correct:

1960 Winter Peak Load Mw	Increase Over 1959 Winter Peak Mw	Increase Over 1959 Winter Peak %	% Over Predicted Winter Peak	% Over 1960 Summer Peak
311.5	15.9	5.4	−4.4	−10.9

James P. Hayward, President
Atlantic City Electric Co

Reverse 'Death Sentence' Clause

To the Editor:

Investor-owned utilities are just now arriving at first class citizenship in the economic community. The scandals of the 30's, of the Hobsons and the Insulls have been almost, but not quite, forgotten. The steady forward progress towards becoming the stalwarts and the bulwark of free enterprise in their respective service areas mark the accomplishments of the past 20-odd years . . .

What (would be) more logical than the operation of the Securities and Exchange Utilities Holding Company Act (death sentence clause) in reverse?

In short, just as the old movies used to show an explosion in reverse by reversing the camera to accomplish an implosion, what now is to prevent utilities from merging where a community of interests exist, and who can gainsay the fact that better service and lower rates that could stem from merger economies do not constitute such a community of interest? . . .

The economies that could be had by standardization of purchasing, billing, accounting, materials, construction practices and the lack of any accounting for load transfers now present under interconnections could present a new concept of operation and management. . . .

Ken Miller
Palo Alto, Calif.

Dateline . . .

Washington, D. C.—The medium-range electric power plans of the "New Frontier" Administration are beginning to take shape. These are just a bit out in front of the anti-recession measures discussed in this column last week, but you are already beginning to see some initial action on these medium-range measures.

Among the developments that utility men will want to keep an eye on are:

- The follow-up on the US-Canadian treaty for power development on the Columbia River. This follow-up will entail closer coordination of power operations between investor companies and the federal government in the Pacific Northwest and a drive to gain Congressional approval of Libby dam.
- A mounting campaign to gain approval for the EHV transmission connection between Bonneville Power Administration and California.
- A fight before the legislative appropriations committees to gain approval for a federal transmission network in the area of the Upper Colorado projects.
- An intensifying campaign to get Congressional indorsement for federal pumped storage projects on the federal reservoir projects first in the Southwest and later in other areas.
- The beginning of a drive to gain Congressional support for interties in the Southwest, eventually linking the Southwest Power Administration system to the Nebraska public power system to the north and the Tennessee Valley Authority system to the east.

Three articles in last week's issue sketched in the details and indicated the follow-up of the US-Canadian treaty. What didn't come through clearly was the rather embarrassing surplus of capacity that existed in the Pacific Northwest last year. This, along with the deficit operations of BPA, puts con-

(*Continued on page* 49)

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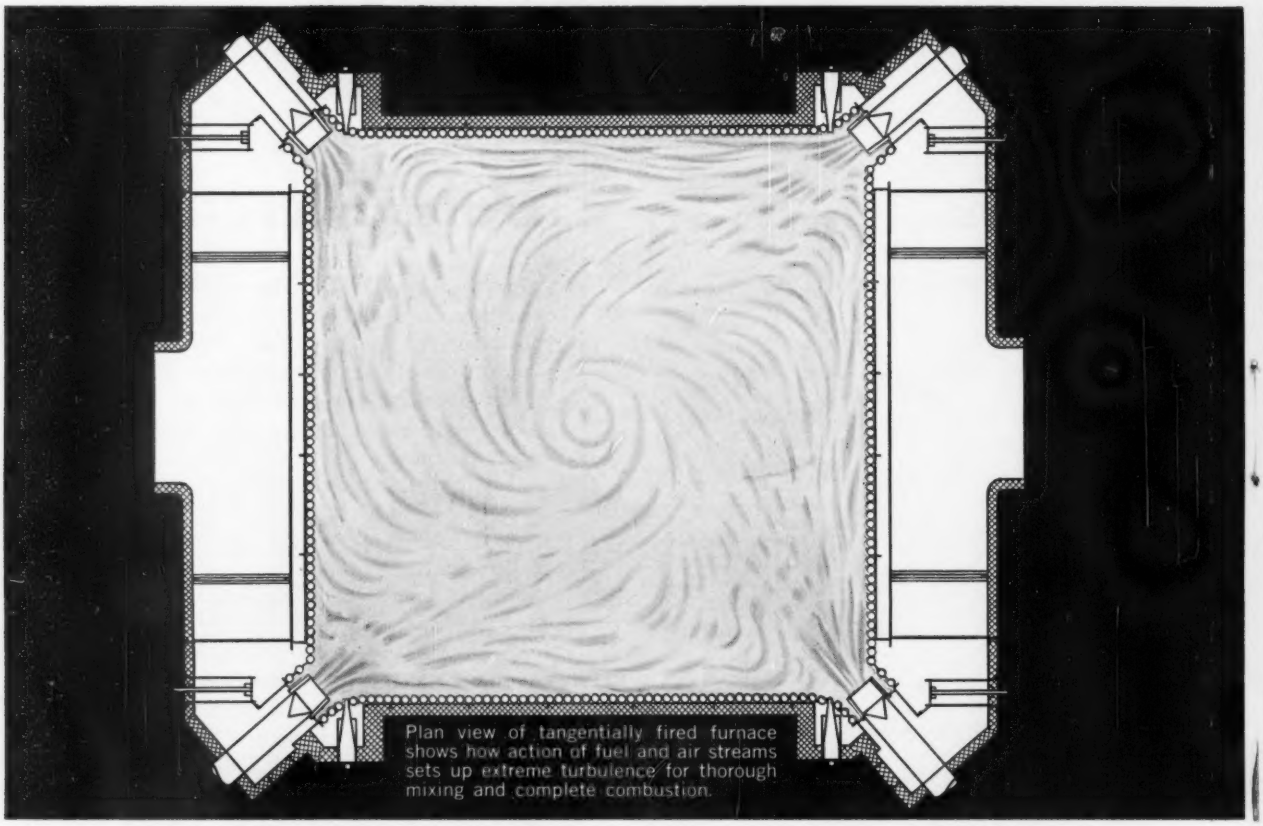
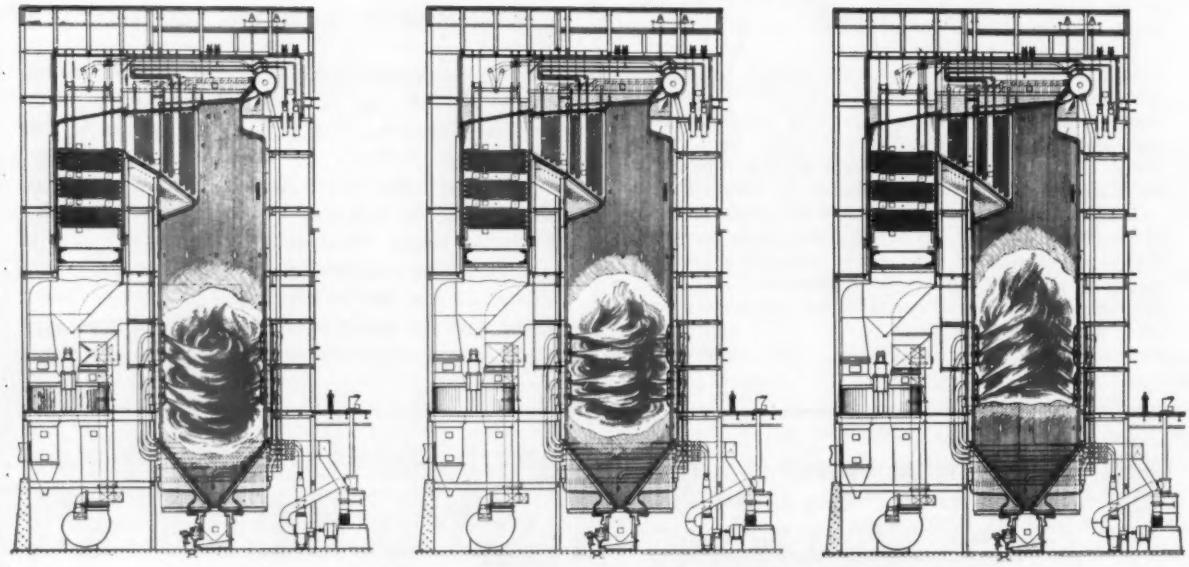


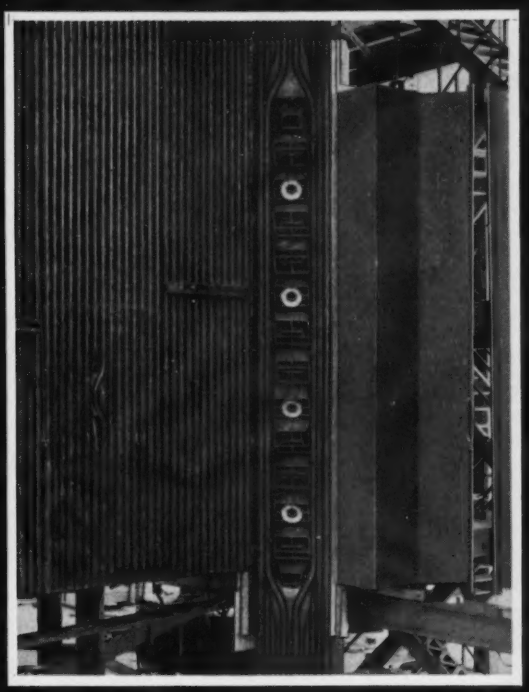
Plan view of tangentially fired furnace shows how action of fuel and air streams sets up extreme turbulence for thorough mixing and complete combustion.

C-E TANGENTIALLY FIRED BOILERS



HOW C-E TILTING TANGENTIAL BURNERS CONTROL SUPERHEAT.

First diagram shows burners tilted downward to reduce furnace outlet temperature. Middle diagram shows normal operating position. Third diagram shows upward tilt to send higher temperature gases to superheater.



Erection view showing shop assembled burner panel being placed in position for welding to wall panels. All four corners of the furnace are similarly equipped.

give more complete combustion... most sensitive steam temperature control

Tangential firing—pioneered by Combustion in 1927—is today the most widely accepted method of firing pulverized coal, gas or oil, separately or together, in large utility boilers. Air and fuel are fed to the furnace in a number of relatively small streams which are directed from each of the four corners of the furnace.

This assures intimate mixing and sets up a strong turbulent motion within the furnace . . . to produce the most complete combustion with minimum carbon loss. The combustion gases fill the furnace for more rapid heat transfer to the waterwalls.

The tilting nozzles of C-E Tangential Burners automatically tilt up or down as steam temperature varies. If steam temperature goes too high, the nozzles tilt downward . . . more furnace wall surface becomes effective . . . gas temperature to superheat surface is lowered . . . steam temperature goes down. Or, if steam temperature drops, the nozzles tilt upward . . . hotter gases go to the superheater . . . steam temperature goes up.

Catalog PC-8 gives full information on tangentially fired C-E boilers, including units with capacities as low as 70,000 lb of steam per hour. Write for your copy today.

COMBUSTION ENGINEERING

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ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT; NUCLEAR REACTORS; PAPER MILL EQUIPMENT; PULVERIZERS; FLASH DRYING SYSTEMS; PRESSURE VESSELS; SOIL PIPE

Industry-proved through a quarter century of service...THERE'S NO DOUBT ABOUT NEOPRENE

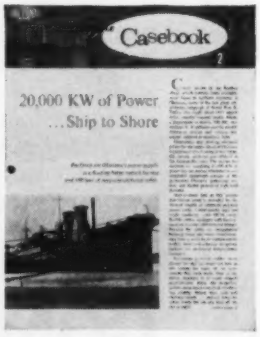
One of American Airlines' fleet of Boeing 707 jet flagships parks at new passenger terminal. Neoprene jacketing protects 68,500 feet of underground lighting cable serving the terminal's apron.

Dependable neoprene jacketed cable lights the apron of another new Idlewild terminal

Marshy soil at New York International Airport poses special problems for underground power cable. Excessive moisture that collects in ducts makes life tough for ordinary jacketing. That's one reason why neoprene jacketed cable has been a standard at Idlewild for years. One of the most recent installations is at American Airlines' new jet-age passenger terminal. Here all underground lighting cable serving the terminal apron is protected with durable neoprene jackets, specially compounded for maximum water resistance.

Neoprene jacketed cable has thoroughly proved itself at Idlewild, as elsewhere. Just in the last two years, over 500,000 feet of neoprene cable has been installed during construction work at other Idlewild terminals . . . and all this is in addition to the uncounted millions of feet that have been buried at Idlewild since the airport's inception in 1942.

Neoprene jacketing's proven resistance to weathering, abuse, temperature extremes, flame, hot and cold flow can mean economical *long term* protection for the cable you use. E. I. du Pont de Nemours & Co. (Inc.), Elastomer Chemicals Dept. EW-3, Wilmington 98, Del.



Free—Du Pont's new
WIRE AND CABLE CASEBOOK
Each issue contains case histories from the electrical industry on the use of neoprene jacketed cables. Subscriptions free on request.

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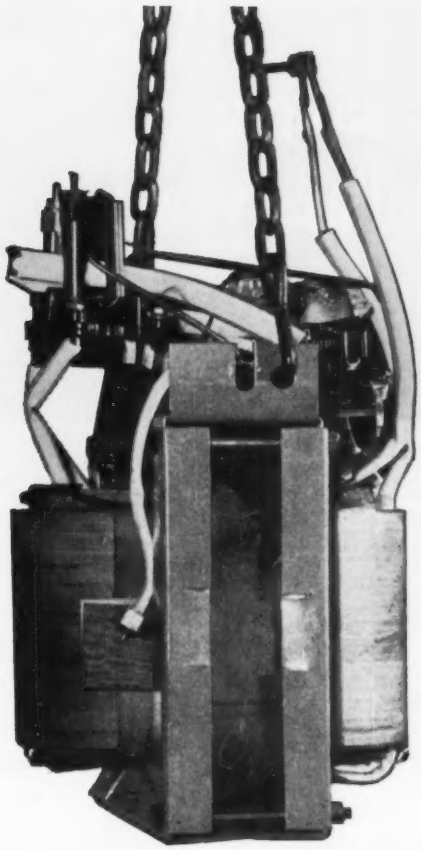
NEOPRENE
SYNTHETIC RUBBER

Better Things for Better Living . . . *through Chemistry*



Rebuild Transformers with WAGNER® CORE AND COIL ASSEMBLIES

Now, more than ever – when you rebuild transformers – it's what goes into the tank that makes the difference. And when you put Wagner® Form W and Form P replacement core and coil assemblies in your rebuilt transformers, the difference is the *quality* your dollars buy.

Wagner replacement assemblies are full NEMA Standard elements, like those used in new Wagner distribution transformers. They give you the advantages of high-efficiency, low exciting current, low impedance, high short circuit and overload capability. These small, light assemblies let you get the most out of uprating, too. In sizes through 15 Kva, you can install the largest core and coils that will fit your tank, and still remain within NEMA temperature rise standards.

Wagner Form W (5 through 50 Kva) and Form P (75 through 167 Kva) replacement assemblies come to you ready to install. They have been fully tested, vacuum-treated and dried, and are packaged in transformer oil for complete protection. Universal mounting brackets are included with each unit, 25 Kva and smaller.

When you rebuild transformers, specify Wagner replacement assemblies. They're a good investment ... that you can count on.

GET LOWER IMPEDANCE VALUES

BETTER REGULATION

LOWER CORE LOSSES

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

Wagner Electric Corporation

6456 PLYMOUTH AVENUE, ST. LOUIS 33, MISSOURI

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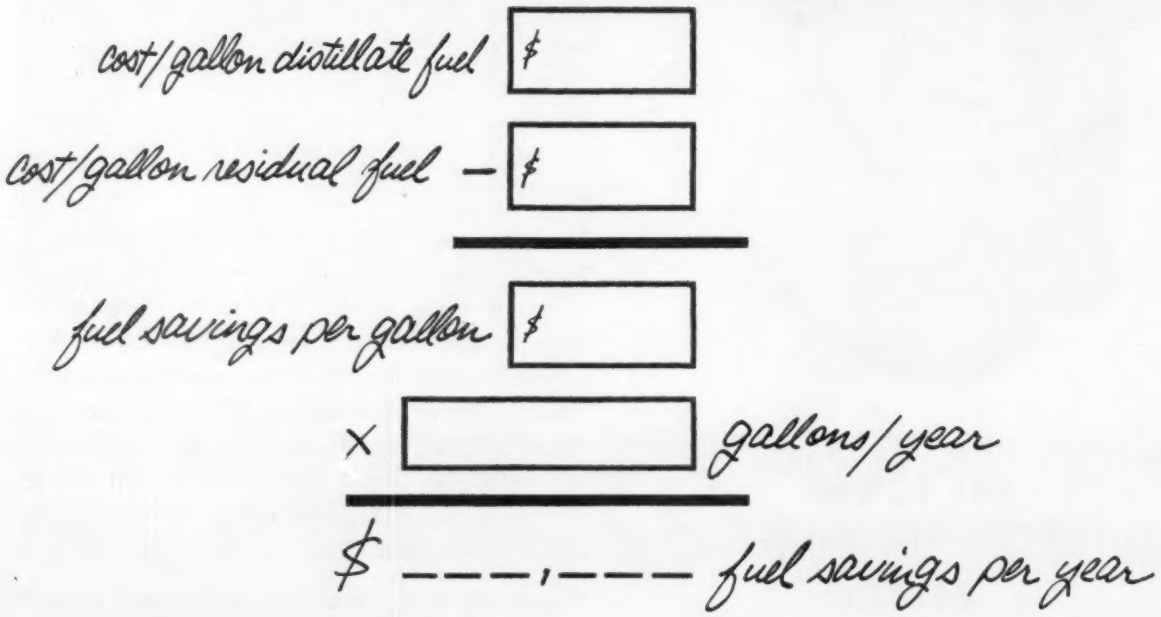
This arithmetic is saving tens of thousands of dollars yearly for diesel generating stations



COST OF AN ACTUAL DE LAVAL OIL PURIFICATION SYSTEM

(Fuel consumption is 2,000,000 gallons per year)

Equipment:	
De Laval centrifuge	$15,000
Fuel heating system	13,500
Fuel circulating system	2,000
Annual Operation:	
Additional maintenance	6,500
Fuel handling	1,000
COST OF FIRST YEAR	$38,000
TOTAL FUEL COST SAVING	$77,500 per year!
NET SAVING AFTER FIRST YEAR	$70,000 per year!

A cooperative station is saving an average of $72,000 each year on an average output of 28,000,000 KWH. A municipal station is saving $44,000 each year on a 9,000,000 KWH output. The proof of these typical fuel savings with De Laval Oil Purification is in the calculation above *which you can make right now* based on local fuel prices. De Laval can help you make the greatest net savings in your own plan to convert to residual fuel.

The heart of the De Laval system is the solids-discharging Centrifugal Purifier which efficiently removes and continuously discharges sediment and sludge without the need for cleaning or supervision. Write for literature describing this cost-saving system —or simply request that a De Laval representative stop by to discuss it with you.

DE LAVAL

THE DE LAVAL SEPARATOR COMPANY
Poughkeepsie, New York or
5724 N. Pulaski, Chicago 46, Ill.
201 E. Millbrae Avenue, Millbrae, Calif.

The cable you see here is *not* interlocked armor. It is Simplex' new C-L-X . . . the completely sealed cable system.

- Completely sealed against liquids and gases.
- Protected against mechanical damage by a continuous, corrugated metallic sheath.
- As pliable as unsheathed cable because of its corrugated design.
- Needs no separate duct or conduit in any environment.
- Nonferrous sheaths can be designed to function as grounds or shielding.

Simplex C-L-X is impervious to liquids and gases, is resistant to all forms of mechanical damage, and is as pliable as unsheathed cable.

Available with sheaths of steel, aluminum, copper or bronze, and with or without outer plastic jacketing, Simplex C-L-X provides the ideal solution for almost any installation, particularly those in which cable life is limited by severe ambient conditions.

Write today for illustrated brochure containing application and engineering information.

Simplex

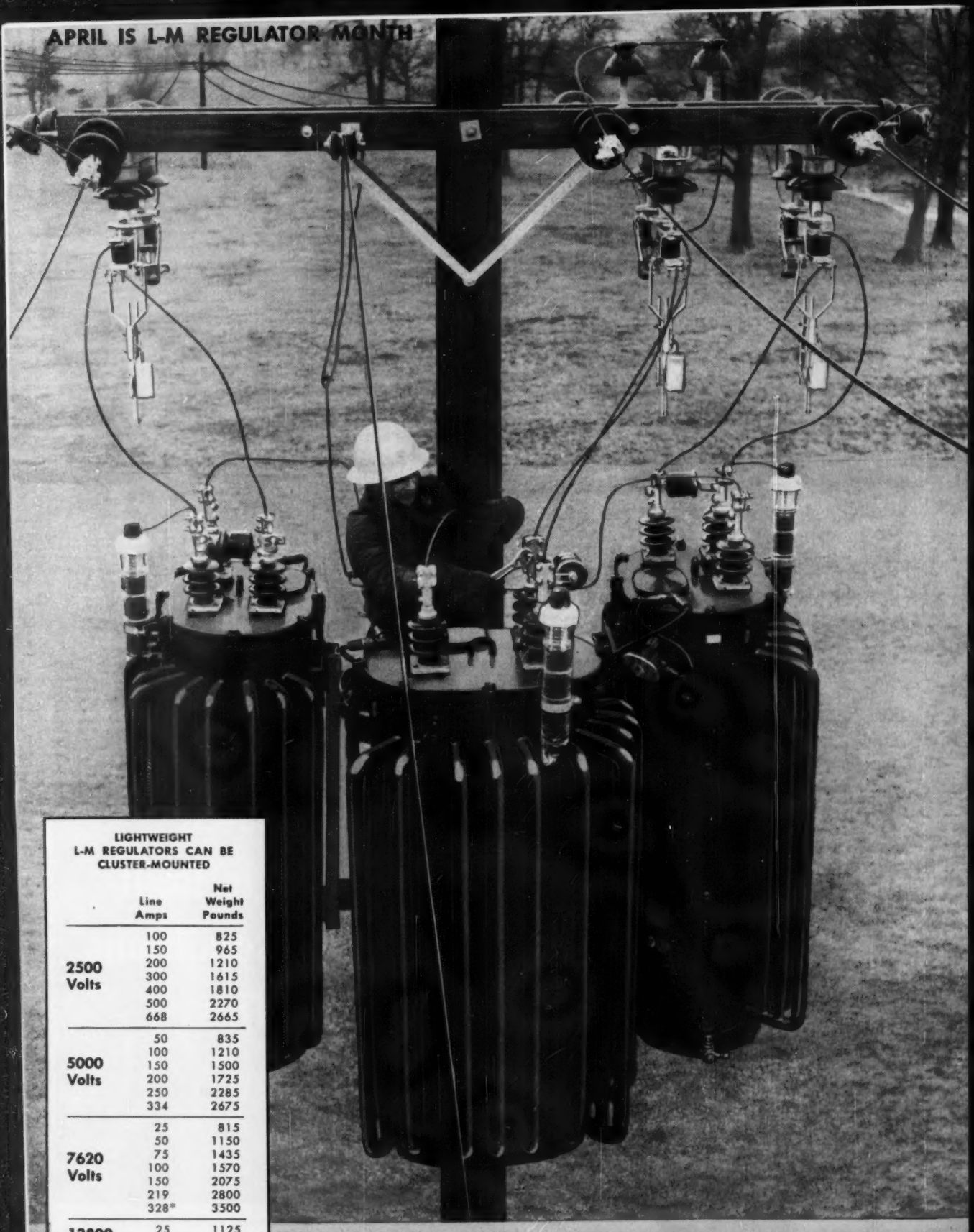
WIRE & CABLE CO.

Cambridge, Mass. • Newington, N. H.

Only Simplex C-L-X . . . the Completely Sealed Cable System . . . is Built for Torturous Conditions Like This

Simplex C-L-X combines cable and duct in one integrated system. Metal, in the form of a continuous flat strip, is formed into a welded tube around the insulated cable. The metal tube is then corrugated to form Simplex C-L-X.

APRIL IS L-M REGULATOR MONTH



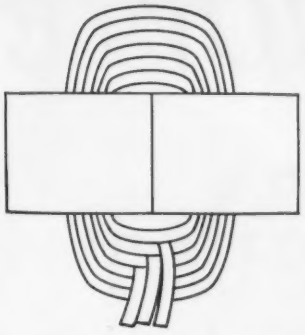
LIGHTWEIGHT L-M REGULATORS CAN BE CLUSTER-MOUNTED

	Line Amps	Net Weight Pounds
2500 Volts	100	825
	150	965
	200	1210
	300	1615
	400	1810
	500	2270
	668	2665
5000 Volts	50	835
	100	1210
	150	1500
	200	1725
	250	2285
	334	2675
7620 Volts	25	815
	50	1150
	75	1435
	100	1570
	150	2075
	219	2800
	328*	3500
13800 Volts	25	1125
	50	1540
	100	2475

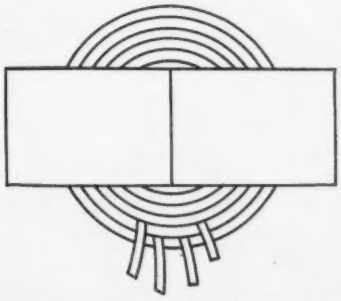
*NEMA standards do not provide for hanger brackets on this size.

5,000 KVA OF LOAD REGULATED FROM A SINGLE POLE! Here, three L-M 219 ampere, 7620 volt regulators are cluster mounted to provide regulation on a 7620/13200 volt multi-grounded wye distribution feeder.

HIGHER SHORT CIRCUIT STRENGTH



OTHERS—competitors wind regulator coils in a rectangular shape. Mechanical forces induced by short circuit current tend to stress these windings into a circular shape. Rectangular windings are less able to withstand these forces.



L-M—incorporates the exclusive Round-Wound design. Coils are circular in shape and are naturally capable of withstanding higher short circuit stresses.

MORE ACCURATE CONTROLS

L-M's exclusive induction-type contact-making voltmeter is a sealed watt-hour movement. It's more rugged, accurate and reliable than balanced-beam types. Band width is adjustable between ±¾ volt to ±6 volts, need not be recalibrated when voltage level is changed. No service interruption when band width is changed; no external voltmeter required; no need to set voltage knob at zero.

REMOTE CONTROL

L-M's control cabinet can be separated from the regulator tank. It may be mounted at any convenient location at or near base of pole. Connections between the regulator and the control cabinet are accomplished by a cable and connectors. Control cables and receptacles are available in a range of standard lengths.

Regulate Up to 5000 Kva of Line Load With L-M's Cluster-Mounted Regulators

Compact Round-Wound® design cuts weight of L-M 32-step voltage regulators for low-cost cluster-mount installations; also provides exceptionally high short-circuit strength.

B. R. BLAKE
Regulator Application Engineer
Line Material Industries

Line Material incorporates the exclusive Round-Wound design in all 32-step voltage regulators. As a result all regulators, with the exception of the largest size, can be either pole mounted or cluster mounted.

Now it is possible to provide regulation on lines in established areas where new construction is impossible. Cluster-mounted regulators not only save space, but also completely eliminate the real estate, construction, and labor costs associated with substation installation.

Get Complete Information

Your L-M Field Engineer will be glad to give you assistance and complete information on the application of L-M regulators. Or write Line Material Industries, P.O. Box 510, Zanesville, Ohio.

OUR 50TH YEAR 1911 – 1961

LINE MATERIAL® Industries *Regulators*

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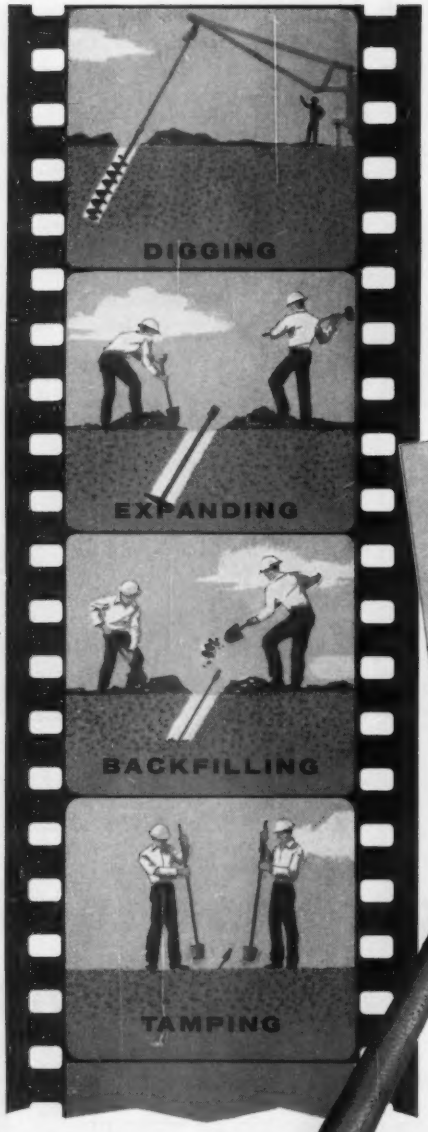
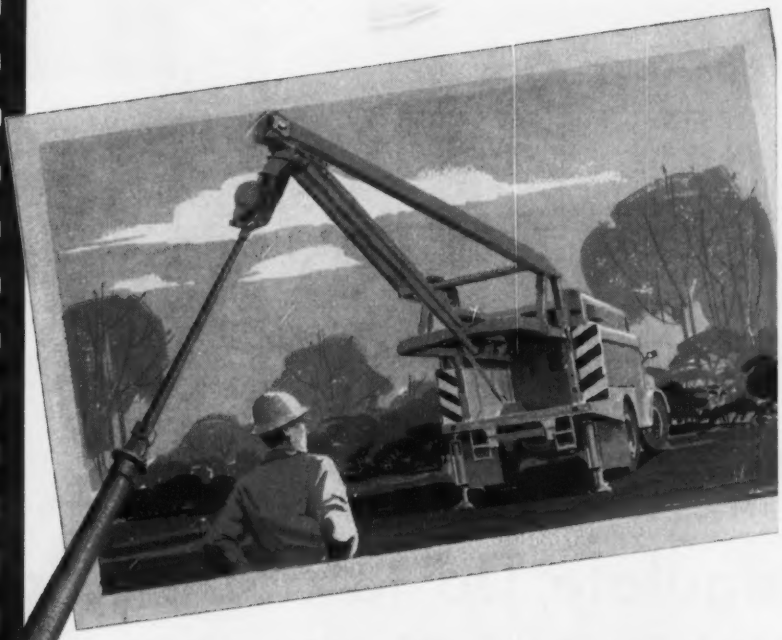
McGRAW EDISON

DISTRIBUTION TRANSFORMERS • RECLOSERS, SECTIONALIZERS AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS • LIGHTNING ARRESTERS • POWER SWITCHING EQUIPMENT
PACKAGED SUBSTATIONS • CAPACITORS • REGULATORS • OUTDOOR LIGHTING • LINE CONSTRUCTION MATERIALS • PORCELAIN INSULATORS • FIBRE PIPE & CONDUIT

Why make a MOVIE?



when a SNAPSHOT will do!



A SINGLE OPERATION!

LESS LABOR • LESS TIME • LESS COST

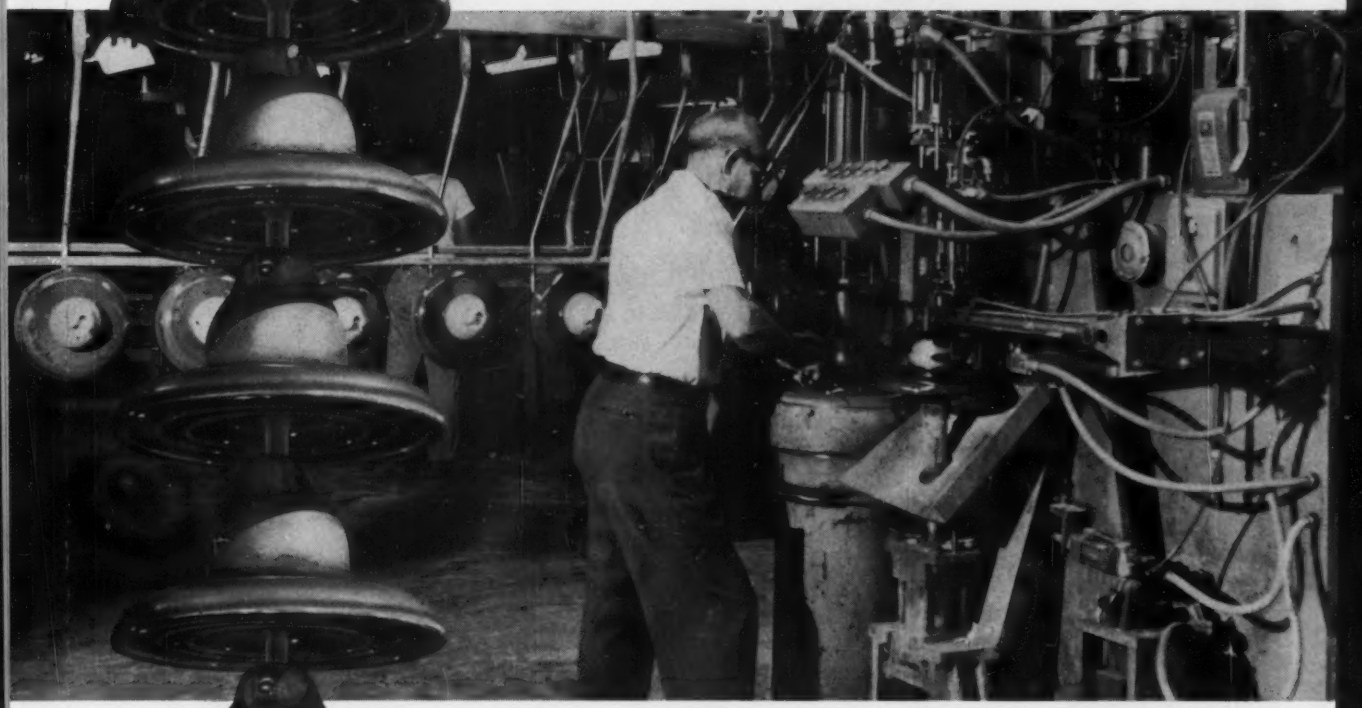
Hubbard *PowerDrive* Anchors

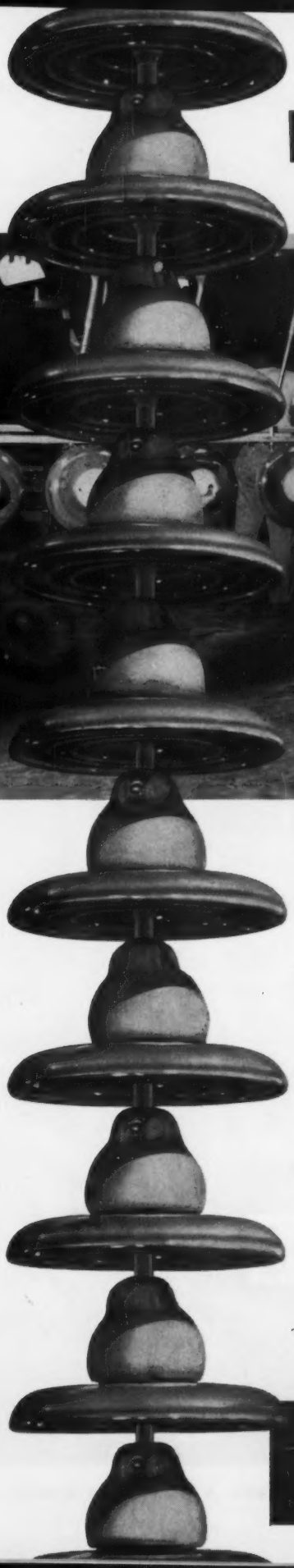
...provide greater holding power, consistently dependable anchors because of minimum disturbance to soil during installation

BETTER PRODUCTS *through Creative Engineering*

HUBBARD AND COMPANY
CHICAGO 50, ILLINOIS

We make 'em good . . .





and we make sure!

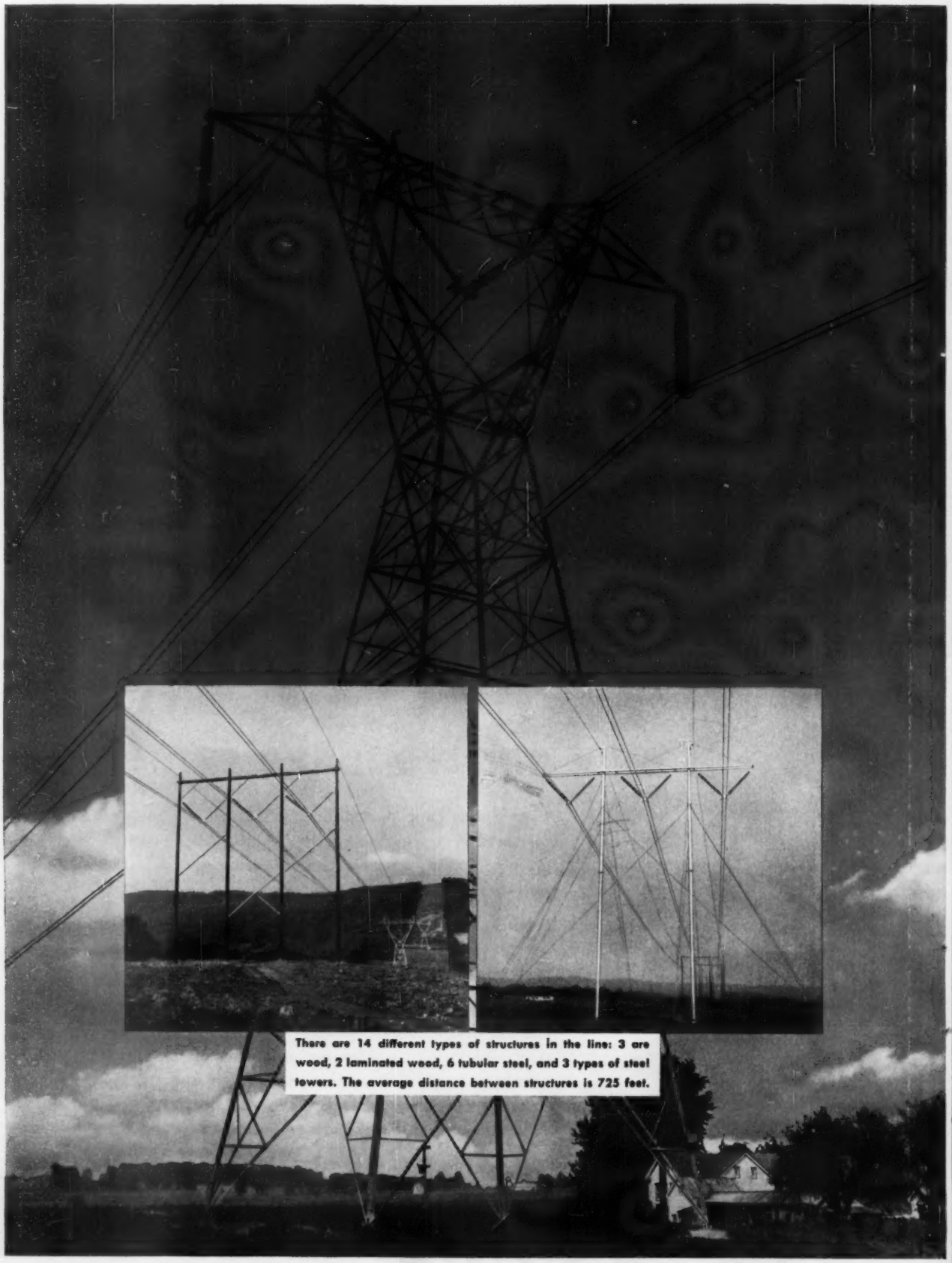
Every single Lapp suspension insulator takes a harrowing cycle of torture tests far more severe than normal service on your lines. The machine in this picture, for example, subjects each insulator to a test pull that will rip the guts right out of any sub-strength unit.

It hardly ever happens. Here at Lapp we're automated for such tight control of production processes that it *can't* happen, except by some freak conditions.

It's all part of Lapp's program of continuous improvement. No sudden, drastic design changes—no juggling of ratings—but constant endeavor to tighten the uniformity of our insulators. Uniformity in strength, in impact resistance, in every measurable characteristic. Uniformity that pays off in the uninterrupted service you expect on Lapp-insulated lines.

Lapp Insulator Co., Inc., Le Roy, N.Y.

Lapp



There are 14 different types of structures in the line: 3 are wood, 2 laminated wood, 6 tubular steel, and 3 types of steel towers. The average distance between structures is 725 feet.

AMERICA'S "BIG-VOLT" LINE protected by ALUMOWELD OVERHEAD GROUND WIRE

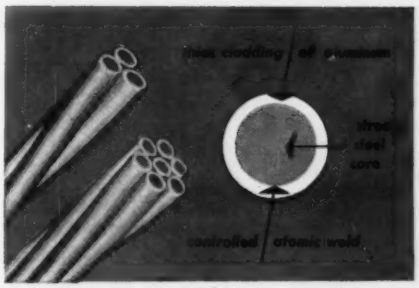
Like the famed "Big Inch" in the oil industry, Pennsylvania Electric Company's "Big Volt," its new 460-KV transmission line, represents a bold step forward in supplying the growing energy needs of America.

To protect the highest voltage operational line in America from lightning and transient currents, Penelec is using Alumoweld Overhead Ground Wire. This dependable, low-cost shield wire has three times the electrical conductance of steel, is just as strong and weighs 18% less. It has the same long life as solid aluminum.

Alumoweld is the result of the first successful cladding of a *thick* layer of pure aluminum over a high-strength steel core. The concentric aluminum covering comprises 25% of the cross-sectional area of each wire. Its high strength-to-weight ratio—higher than any other overhead ground wire—permits stringing with greater mid-span clearance to provide maximum lightning protection. Alumoweld's excellent conductivity assures reliable operation of protective relays and effectively discharges transient currents to ground.

Order Alumoweld Overhead Ground Wire and get Low-Cost, Long-Life Protection for your transmission lines.

For more complete Alumoweld data send for Engineering Bulletin E.D. 3000.



A seven-strand Alumoweld Overhead Ground Wire (7 No. 6 Awg wires), approximately ½-inch in diameter with a breaking strength of over 22,700 pounds, is used to protect the highest voltage transmission line in America.

ALUMOWELD®

COPPERWELD STEEL COMPANY

WIRE AND CABLE DIVISION Glassport, Pa.

For Export: COPPERWELD STEEL INTERNATIONAL COMPANY, New York

Canadian Distributor: NORTHERN ELECTRIC COMPANY LIMITED

Improved

G&W

High Voltage

POTHEADS

offer simplified design; lower cost

Simplification of G&W's original Type AT pothead design has resulted in lowering costs of the new high voltage pothead line, ATA-N and ATL-N. The outstanding mechanical and electrical characteristics which have been responsible for the fine performance of the original Type AT potheads have been retained. Maximum interchangeability of parts is one of the advantages gained by the simplified design. Also, the use of a straight-through type ferrule provides a more stable connection to the overhead line.

A new means of retaining gaskets is a definite improvement in sealing against high pressure. Successful tests up to 750 psig of hydrostatic pressure indicate that these improved G&W Potheads have superior performance characteristics under operating static heads in excess of 200 psig (nominal).

Type ATA-N and ATL-N potheads are another example of the constant improvement being made in G&W products. Their performance and dependability is based upon G&W's thorough understanding of electrical and mechanical requirements for cable accessories gained from 55 years of engineering development, testing, and operating experience. Consult with a G&W Representative on your present and future cable termination needs, or write us for full information.

G&W ELECTRIC SPECIALTY COMPANY

3500 WEST 127TH STREET • BLUE ISLAND, ILLINOIS

CANADIAN MFG. • POWERLITE DEVICES LTD. • TORONTO, MONTREAL & VANCOUVER

superior quality standards — inspired specialized design

AT60-1

Electrical World

MARCH 27, 1961
Vol. 155, No. 13

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NEXT WEEK

DON'T MISS 12-page special report on industrial electrical systems.

LATE NEWS ▶ **New Kennedy budget adds $50 million** to Eisenhower requests for rural electrification loans, and another $50 million for telephone loans. Eisenhower had asked for $115 million in new loan funds plus $30-million reserve for contingencies. Kennedy has lumped two Eisenhower categories together and boosted total to $195 million . . . **Kennedy also asks $2,314,000 increase for BPA,** raising total to $18,020,000. Increase would be for five new transmission lines, with eventual cost of $34,405,000. They include: two 230-kv lines to Oregon coastal areas of Tillamook and Reedsport; a 345-kv line from Seattle to Canadian border, linking to B. C. Electric Co and intended to be used with Columbia River development; a 345-kv line from Portland to The Dalles, to be extended later to John Day Dam; a 115-kv line from Lebanon, Ore., to the Green Peter Dam site . . . Although request for Bureau of Reclamation is not boosted, **Kennedy will "reprogram" funds** to allow completion of "a number" of investigations, probably including huge Alaskan Rampart Dam and Montana's Libby Dam. Juggling could also free funds for federal transmission in Upper Colorado and in California's Central Valley project . . . **No change is asked** for Southeastern or Southwestern Power Administration. Revised requests for TVA and Corps of Engineers are still to come. Supplemental requests are also expected for BPA-California tie and for additional funds for Libby Dam.

Chief of the Corps of Engineers, Lt-Gen Emerson Itschner, will retire Mar. 31 to take post with Harza Engineering Co as chief technical advisor on the Indus River project in Pakistan. His successor will be named by special military board. Itschner, 57, was given unprecedented two-year extension when his three-year term expired last year.

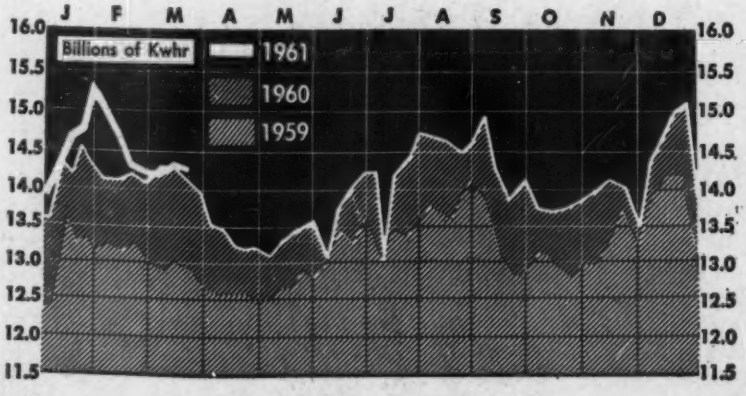
President Kennedy formally asks Senate to confirm Joseph C. Swidler as member of FPC despite announced opposition from Congress. Request did not name Swidler as chairman. Kennedy also asked Senate to confirm Howard Morgan for FPC.

FPC has no jurisdiction over Southern Cal Ed's sales to city of Colton, Calif., rules Examiner Harry Frazee, even though some of power may come from USBR's Lower Colorado dams. Frazee pointed out that Boulder Canyon Acts gave Interior jurisdiction over sales from these dams and that Calif. PUC has interstate jurisdiction. Decision is subject to final action by full FPC.

Management changes: William M. Babcock is new chairman of Central Illinois Light Co; George W. Hathway, new president.

WEEKLY POWER OUTPUT—Up 0.5%

(Week ending Mar. 18), Kwhr 14,295,000,000



Per Cent Change From Previous Year

	Mar. 4	Mar. 11	Mar. 18
Total U. S.	− 1.0	− 0.2	+ 0.5
New Eng.	+ 3.6	+ 4.8	+ 5.9
Mid. Atlan.	+ 1.6	+ 2.3	+ 4.2
Cent. Indust.	− 7.1	− 5.8	− 4.0
West Cent.	+ 1.1	+ 1.2	+ 3.1
Southeast	− 4.0	− 5.8	− 5.0
South Cent.	+ 2.2	+ 2.4	+ 3.6
Rocky Mount.	+ 9.1	+12.1	+ 9.6
Pacific			
NW	− 0.9	+ 2.8	+ 3.6
SW	+11.5	+15.7	+10.0

Seasonally Adjusted Index 277

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Source: Edison Electric Institute

Supply Lines

ARE EQUIPMENT PRICES READY TO MOVE UPWARD?

Are equipment prices ready to begin their long climb towards what suppliers consider to be profitable levels? Three straws in the wind during recent weeks indicate that this might be the case. First came the announcement of Federal Pacific Electric Co, Sangamo Electric Co, and Allis-Chalmers Manufacturing Co saying that they were raising the price of 50-kvar power capacitors from the $100 level to $117. Then came the news that I-T-E Circuit Breaker Co was calling "time out" from quoting low prices to lure new customers or win sealed bid business. Finally there was the issuing of new power transformer prices by Allis-Chalmers which were above the current market level. In response to a query last week, A-C said it intended to quote these higher prices. (EW, Mar. 6, p 13; Mar. 13, p 21; Mar. 20, p 25.)

Taken separately, these straws don't mean much. The market price for capacitors, at last report, was still $97.33, and whether or not I-T-E quotes on a specific job does not influence over-all prices much. Nor does A-C expect to raise the price of power transformers overnight with its move. In addition, there can be a big difference between what a supplier says it will do and what it actually does when faced with specific realities.

But taken together, these straws indicate that more than one supplier is having second thoughts about continuing to operate in the presently depressed market. And when some sellers have these second thoughts the thing can snowball, usually causing prices to start a slow upward trend.

Whether or not these present moves turn out to be abortive now, they will probably be tried again, by the same or different companies. Eventually, some of these moves will stick. Therefore, the thing to watch as buyers is whether these companies mean what they say now.

JUSTICE DEPARTMENT ORDERS PROBE OF COPPER AND BRASS INDUSTRY

The US Justice Department has ordered a broad antitrust investigation of the US copper and brass industry, with a particular eye on the pricing of brass products fabricated in the New England area. A federal grand jury is being convened in Hartford, Conn., and is expected to start taking closed-door testimony on industry practices about April 17. Justice Department attorneys from Washington and New York will guide the jury's investigation.

Brass products used in the electric industry probably will be involved in the investigation. Government sources stressed that the investigation will be "broad," covering most brass products.

In another development, Justice Department officials are frowning on various plans for a world arrangement to stabilize price and production of copper. One such idea came from Senate Majority Leader Mike Mansfield (D-Mont.), who asked President Kennedy to call a conference to seek world stabilization of copper.

More recently, the Chilean government has proposed that a number of copper-producing companies act to stabilize copper production and price levels. The Justice Department is prepared to warn any US copper company that participation in such a group would be in violation of antitrust laws. But the general immediate

reaction of US copper producers to Mansfield's original proposal was negative anyway (EW, Feb. 27, p 16).

PRICE ADJUSTMENTS MADE ON INSTRUMENT TRANSFORMERS

Price adjustments on both dry-type and liquid-filled instrument transformers have been announced by General Electric's meter department, effective March 13. On dry-type units, discounts have been increased 1%, while on liquid-filled units, discounts have been reduced 1%. As reasons behind the price moves, the company stated lower and higher manufacturing costs, respectively.

CALIFORNIA ASKS TO SEE PHILADELPHIA GRAND JURY SUBPOENAS

The state of California has asked the federal court in Philadelphia to permit the state to see the subpoenas issued during the grand jury investigations into the electrical manufacturing industry. The state says this would help it in assessing damages resulting from the antitrust cases. The Justice Department is supporting this motion and said it would like the information involved to be a matter of public record.

While this would make public the names of those who testified before the grand juries as well as the scope of the documents subpoenaed, the documents themselves would still remain secret. Their public release would take a further motion. The court has not ruled on whether to let California see the subpoenas, but some manufacturers are expected to oppose the motion.

NO SUCCESSOR NAMED TO GE'S GINN; BURENS ALSO RESIGNS

In a matter related to the antitrust cases, General Electric Co has not yet named a permanent successor to Vice President William S. Ginn, who resigned from the company. In the meantime, Group Vice President Clarence H. Linder has assumed Ginn's duties as general manager of the turbine division.

Ginn was one of three GE executives receiving jail sentences in the antitrust cases. Of the other two, George Burens, former vice president and general manager of the switchgear and control division, last week also resigned from the company. The third, Lewis J. Burger, former general manager of the same division and now manager of the component products division's laboratory, said he had not decided yet whether to leave the company.

In his letter of resignation, Ginn said it was his "conclusion that current circumstances, and particularly the relentless publicity involved, has severely limited my effectiveness in my present position or any other future management position with the General Electric Co. Thus it would be a disservice both to myself and the company to ignore this reality. My responsibility to my family and myself have led me regretfully to the conclusion that I should establish my future business career elsewhere."

Smogtypes need corrosion protection most!

extra leakage distance is no substitute for protection of C. I. S.*

Contaminated atmospheres are the "normal habitat" of Smogtype insulators.

It's an unhealthy environment. In areas of extremely severe contamination, even Smogtypes -- conventional Smogtypes, that is -- may not have what it takes to survive.

For a conventional Smogtype's only defense against the highly corrosive effects of contaminated atmospheres is the extra leakage distance afforded by longer porcelain petticoats. And sometimes, as the accompanying picture shows, extra leakage distance is not enough.

The Smogtype shown in the above illustration accomplished its intended purpose of protecting a 69-kv line from flashover (for a time), but it couldn't protect itself from the corrosive attacks on the pin which eventually destroyed it.

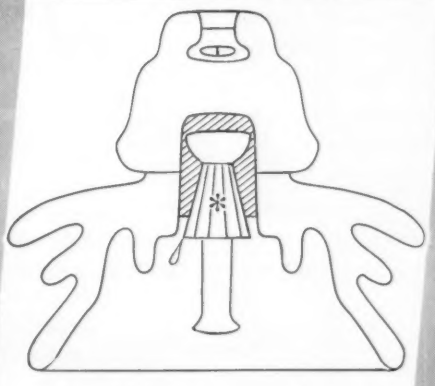
If you have to pay the 50% premium for Smogtypes in order to protect your lines from severe contamination, doesn't it make good sense to protect the *insulators themselves* from the corrosive effects of that contamination?

If contamination or corrosion is your problem, then Futura is -- or should be -- your insulator.

Why not talk it over with your O-B representative?

OHIO BRASS COMPANY, MANSFIELD, OHIO

*CORROSION INTERCEPTING SLEEVE



Futura Smogtype With C.I.S.*

Futura's Corrosion Intercepting Sleeve (C.I.S.) protects against corrosion in two ways. Corrosion products normally deposited on the pin above the cement line, form instead on the yieldable metal sleeve, which gives slightly to eliminate bursting forces on the porcelain. Sleeve also tends to act as a drip shield, diverting moisture (and the corrosive salts dissolved in it) from their customary destructive path down the pin shank.

Ohio Brass

HOLAN

PORCELAIN INSULATORS • LINE HARDWARE • CAPACITORS • LIGHTNING ARRESTERS BUSHINGS • HOLAN TRUCK-MOUNTED POWER DEVICES AND BODIES • BRONZE VALVES

10083-H

You've got to have some answers...before you throw the switch!

Many of today's widely publicized EHV projects are experimental in nature, posing questions that can be answered only after construction is finished and the switch is thrown!

Regardless of how "experimental" any such project is, however, one fact should be obvious: some questions have to be answered *before* the switch is thrown!

This applies especially to suspension insulator assemblies. Unless they are equal to the job of supporting and insulating heavy conductors at elevated voltages, the project will prove nothing.

In the selection of suspension assemblies, therefore, the need is for *experience* rather than *experimentation.*

This was true of the 500-kv Tidd project in 1946, the 500-kv Leadville project in 1956, the 460-kv Penelec project in 1960, the 750-kv Apple Grove project in 1961, and of many other less widely publicized experimental projects past and present.

It's a point of no small significance that the builders of these projects looked to Ohio Brass for suspension assemblies of sound design and proved reliability.

The reasons are twofold:

1) the fact that O-B has the extensive laboratory facilities required to duplicate "in our own backyard" the most rigorous service requirements ever contemplated by our customers;

2) the fact that O-B insulator assemblies have a proved history of experience behind them - - our experience in making them - - customer experience in using them - - 50 years of experience with well over 50 million units!

When you need answers - - *before* you throw the switch - - why not come to O-B?

OHIO BRASS COMPANY, MANSFIELD, OHIO

10084-H

Ohio Brass

HOLAN

PORCELAIN INSULATORS · LINE HARDWARE · CAPACITORS · LIGHTNING ARRESTERS
BUSHINGS · HOLAN TRUCK-MOUNTED POWER DEVICES AND BODIES · BRONZE VALVES

O-B experience in extra high voltage provided answers for Penelec 460 kv line

70% MORE WORKING RANGE with

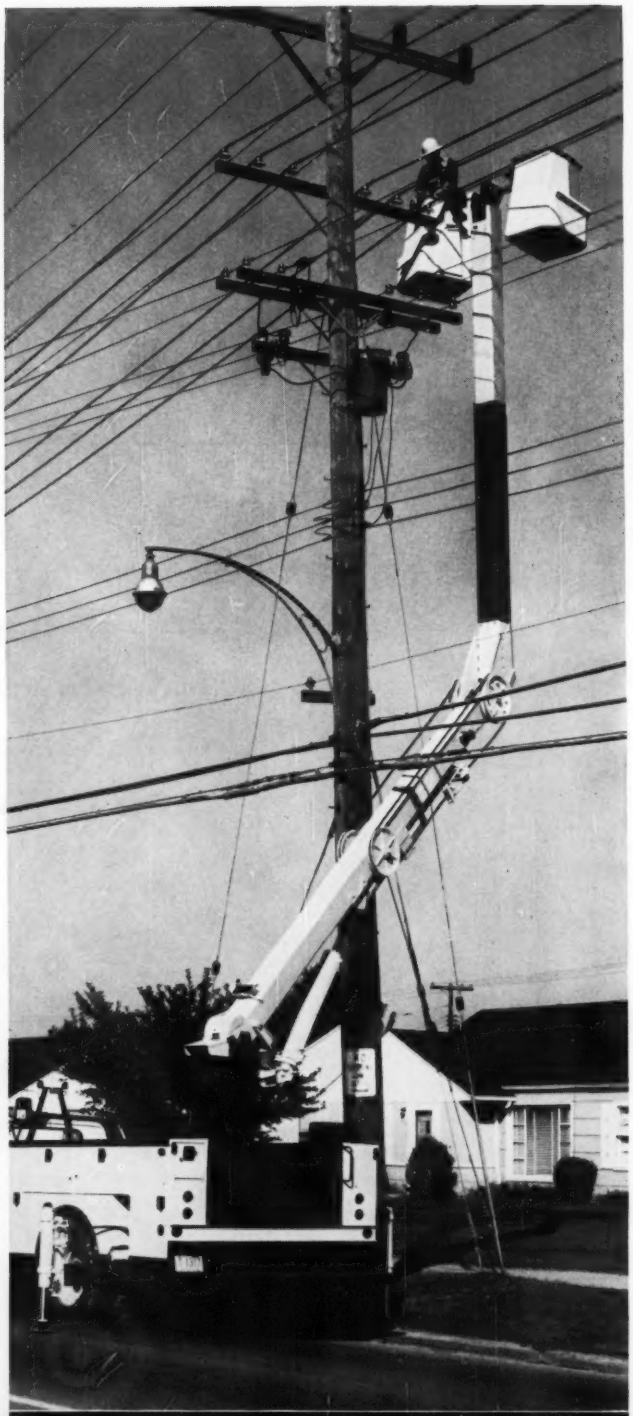
Holan's Unlimited* Action HD-50 Elbow

Holan's unlimited* action Elbow will go straight up . . . or straight out . . . or 13 feet below street level. It has 70% more working range than limited action aerial arms . . . and will put your linemen in a greater variety of working positions than any other aerial arm on the market today.

But it requires "beefed-up" chassis reinforcement and special supporting jacks to offset the tremendous loads. Features like these increase the original cost . . . but less truck maneuvering saves time and dollars in the long run . . . and more than justifies the additional cost of the full-action Holan Elbow.

Safety demands rigidity . . . precise control of the upper arm . . . and fiberglass buckets certified tested at 50,000 volts (A.C.). The upper arm of the Holan Elbow will withstand a one-minute, 200,000-volt (A.C.) dry bucket-to-ground test.

If you require less than full action, see our medium duty or light duty limited action Elbows and our new 65-foot model. And for the very latest in Holan aerial equipment, be sure to ask about the new Holan "Squirt Boom."



Parked at the curb, a limited action, two-man bucket aerial arm could not possibly get in this working position. An unlimited* action Elbow goes under the low-hanging communication cables, then up the property side of the pole without moving the truck.

*** 270° UPPER ARM AND 120° LOWER ARM TRAVEL**

Holan Corporation, 4100 West 150th Street, Cleveland 35, Ohio

Holan

Subsidiary of THE OHIO BRASS COMPANY

HOLAN

BE SURE YOU GET

Quality Appearance Quality Operation

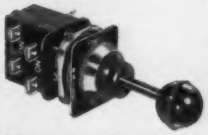
Specify Allen-Bradley's line of ***OILTIGHT CONTROL STATIONS***

Allen-Bradley oiltight units and stations harmonize with the trim lines of modern machine tools —they look as if they were a part of the machine. Also, from the wide selection of control units, you'll be able to satisfy every operating requirement. A-B control units are positively oiltight—impossible for oils and cutting fluids to foul the contacts. And the silver contacts assure reliable operation. The rugged construction and generous wiring room of all A-B stations are valued by the installation engineer. Insist on Allen-Bradley pilot control units and stations—you can't make a mistake! Send for Publication 6090.

FLUSH HEAD
push button, also made with extended head.

WING LEVER PUSH BUTTON
Combines push button and selector switch.

PUSH-TO-TEST PILOT LIGHT
Six different color lenses available.

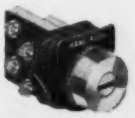


4-WAY SELECTOR SWITCH
Also furnished for 2-way operation.

PILOT LIGHT
Transformer or full voltage types.

DOUBLE CIRCUIT
Has 2 N.O. or 2 N.C. sets of contacts.

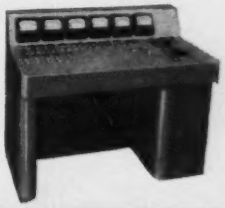
PILOT LIGHT CLUSTER
Four lights of different colors in one unit.



SELECTOR SWITCH
With coin slot operator. Other operators available.

CONVENIENCE RECEPTACLE
For plugging in work light or small tools.

SPECIAL CONTROL CONSOLES
can be furnished to meet your exact operating requirements.



SIX-UNIT CONTROL STATION
in die cast aluminum housing. Also made with up to 4 vertical rows with 4 units per row.

ALLEN-BRADLEY

Member of NEMA

Allen-Bradley Co., 1327 S. First St., Milwaukee 4, Wis. In Canada: Allen-Bradley Canada Ltd., Galt, Ontario

QUALITY MOTOR CONTROL

FISHER-PIERCE MODEL 6600A installation on an access road to the Nimitz Freeway in Oakland

Irrepressible Californians are Never Satisfied with the Status Quo

Right now they're dredging a channel to make a seaport out of Sacramento, some 40 miles from salt water. Already, landlocked Stockton has been made into a thriving ocean port. This kind of forward-looking attitude seems to be characteristic of California, homeland of Pacific Gas & Electric Company.

Progressive thinking is also typical of mammoth PG&E, serving 6.7 million people in Northern and Central California. Here's some evidence: a 1400-mile pipeline project to tap Canadian natural gas resources; the only American generating station using steam from natural geysers; construction of the largest steam-electric plant in the Western U. S.

The same kind of progressive thinking prompted PG&E's decision to use individual photoelectric controls on street lights in all new construction areas. Multiple individual control permits supply from secondary lines, greatly reducing initial costs. Further, with no high voltage series street lighting wire, pole work is simplified and made much safer. Another dividend of uncluttered poles — better appearance — is also important to those irrepressible Californians.

LARGEST STEAM-ELECTRIC POWER PLANT in the West is the Pittsburg Power Plant in the San Francisco Bay area. Two 330,000-kilowatt generating units being added on the left will increase capacity to 1,320,000 kw in 1961, raising PG&E system capacity to nearly six million kw.

Why Fisher-Pierce 6600A Controls?

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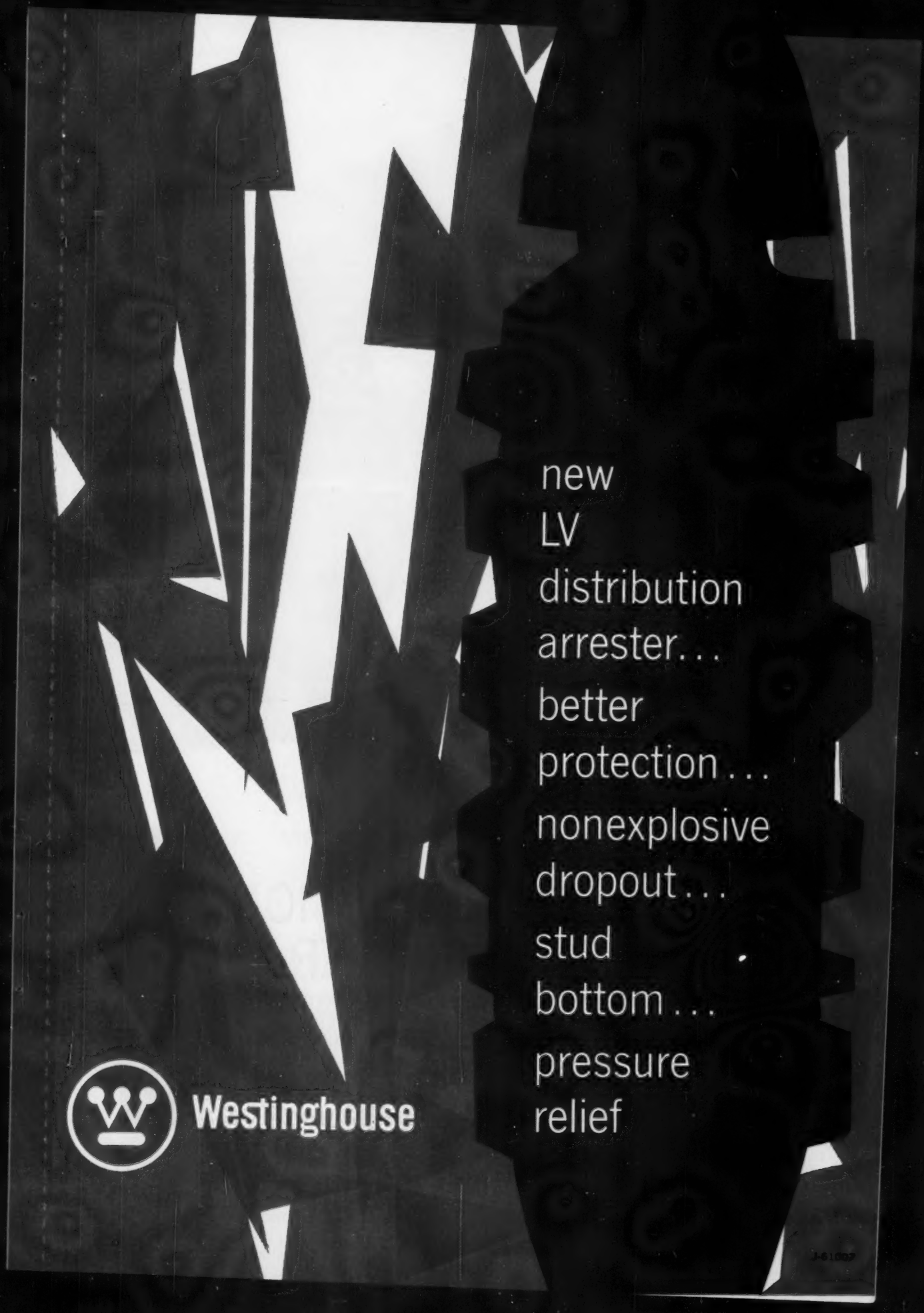
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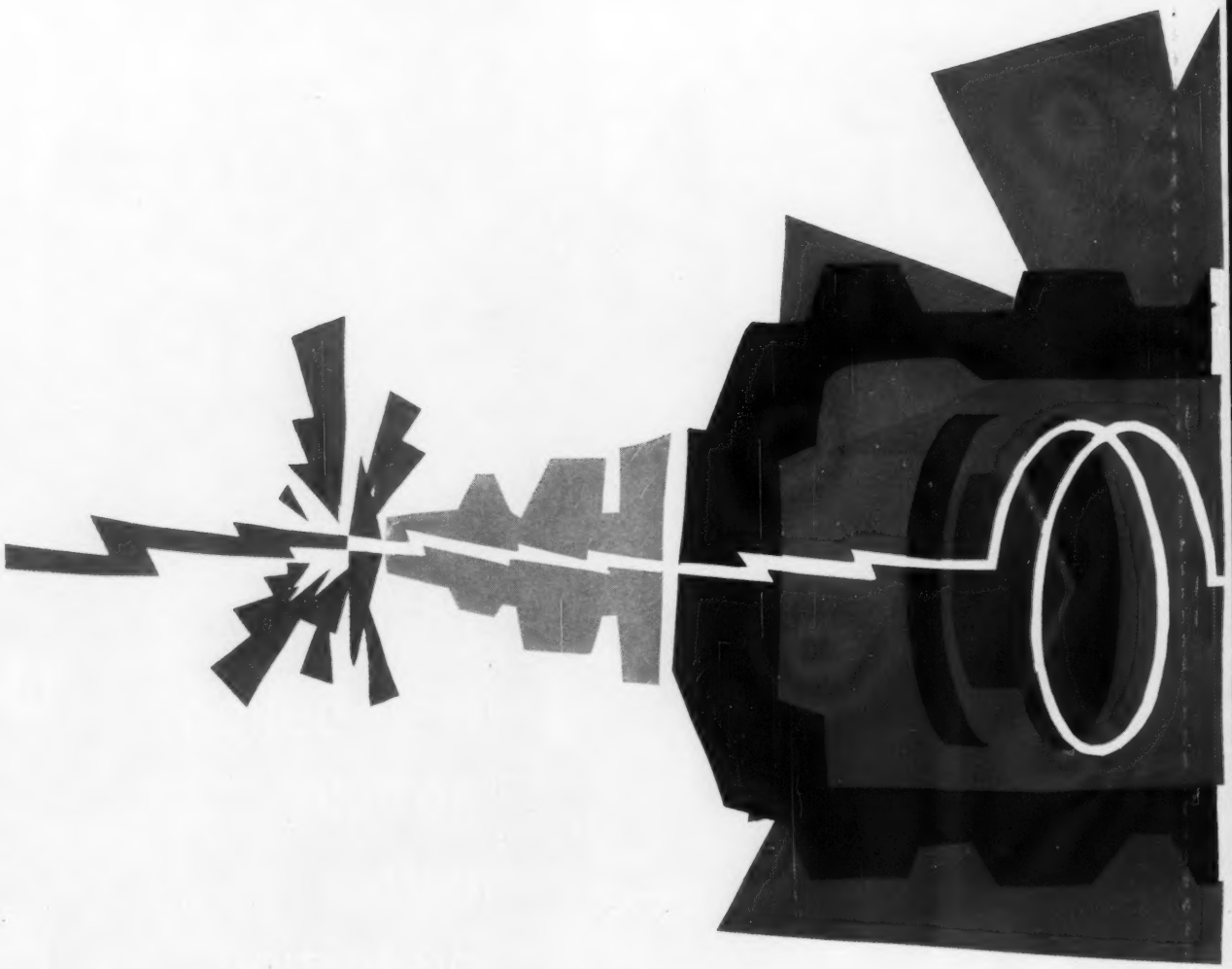

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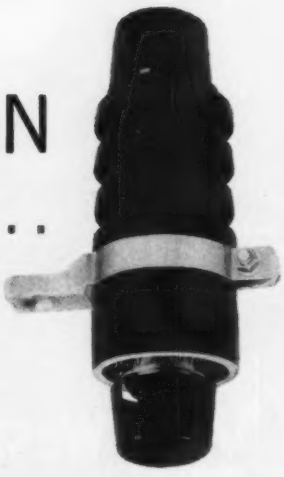

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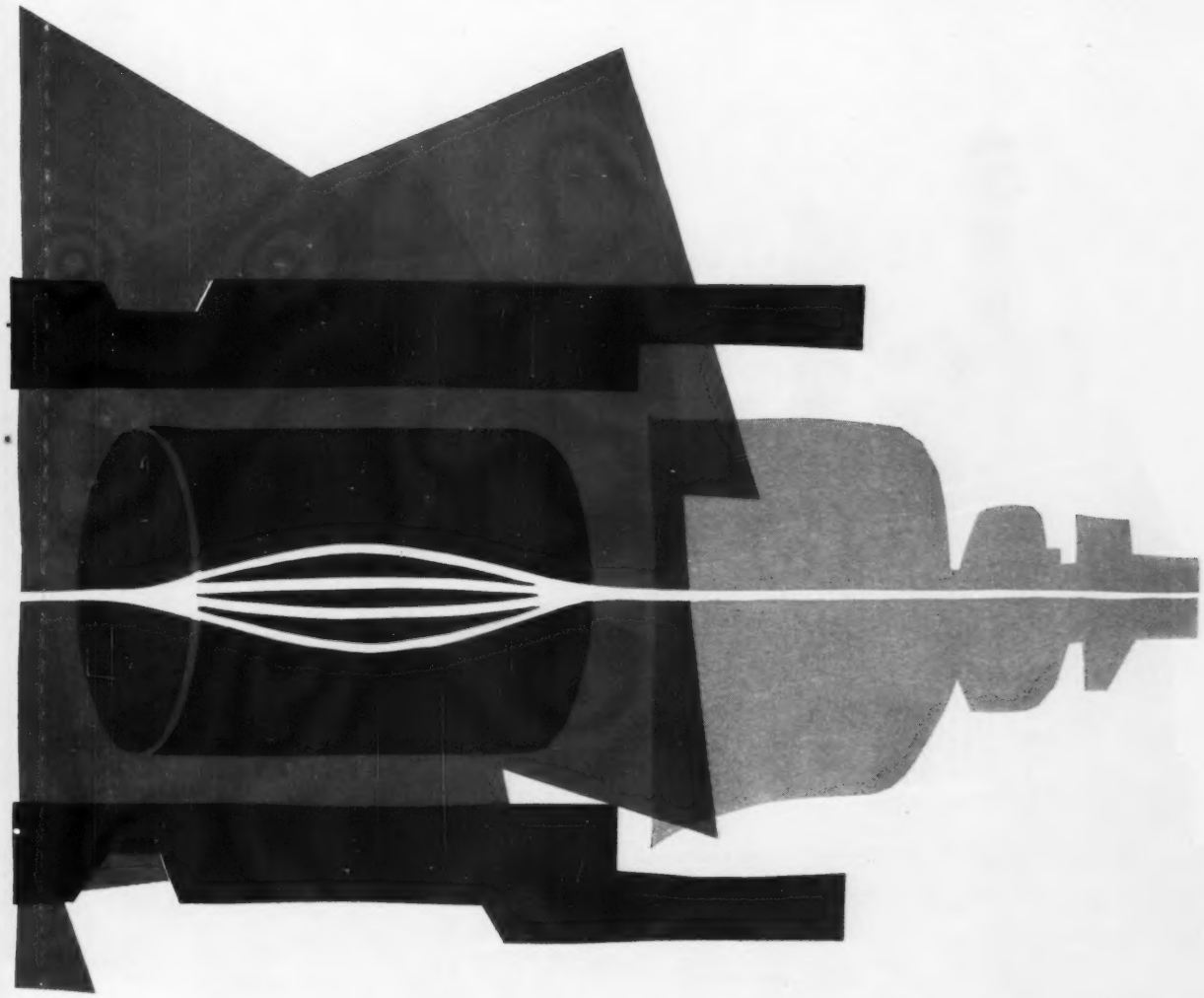

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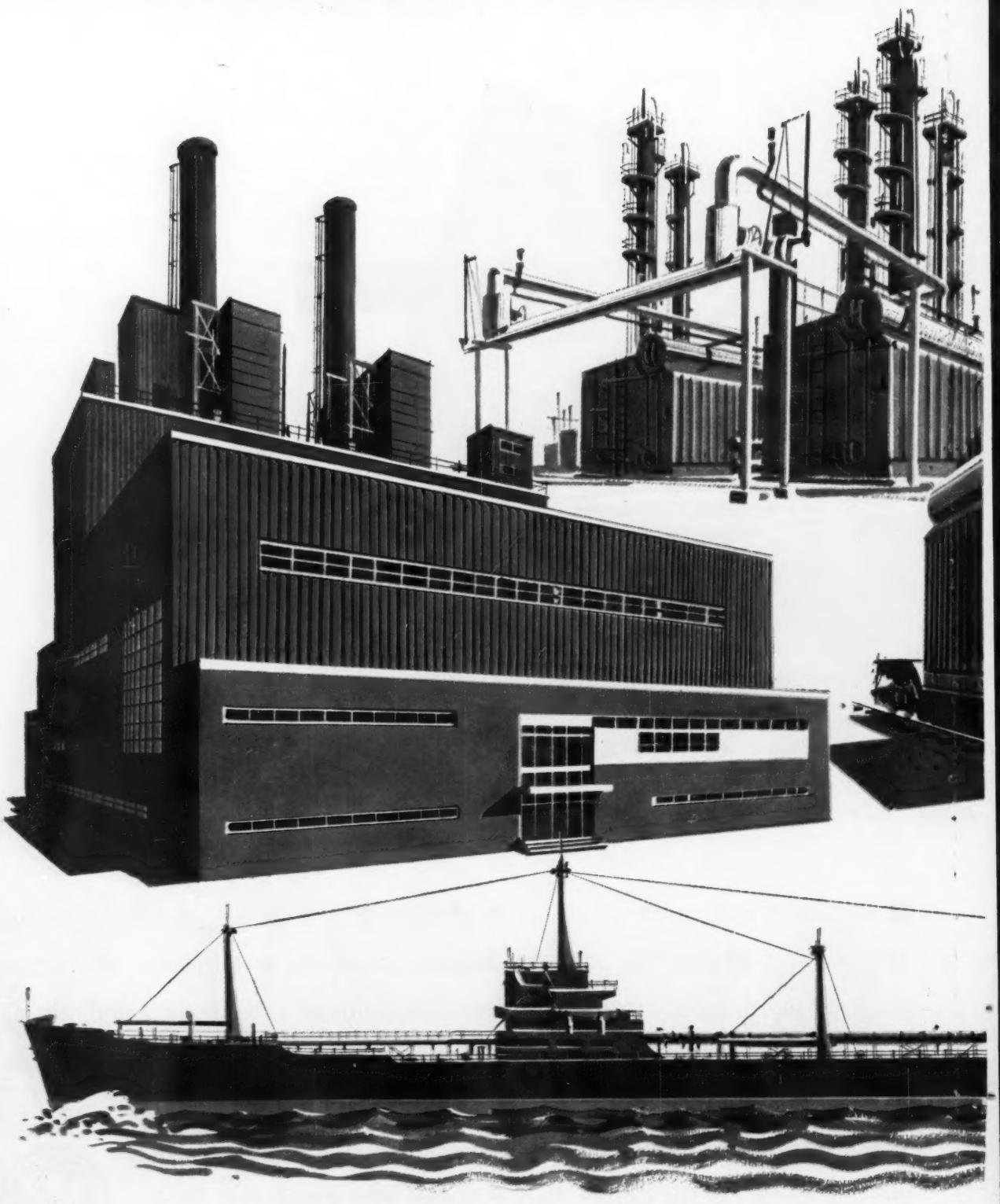

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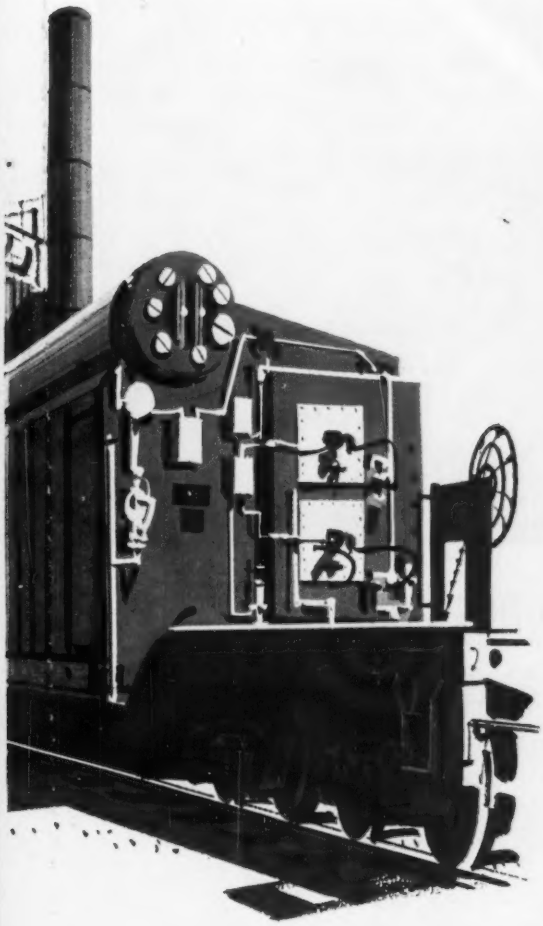

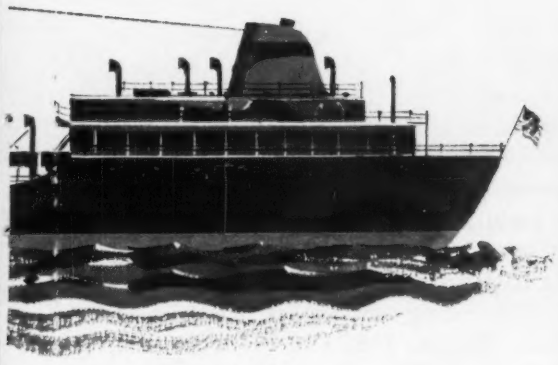

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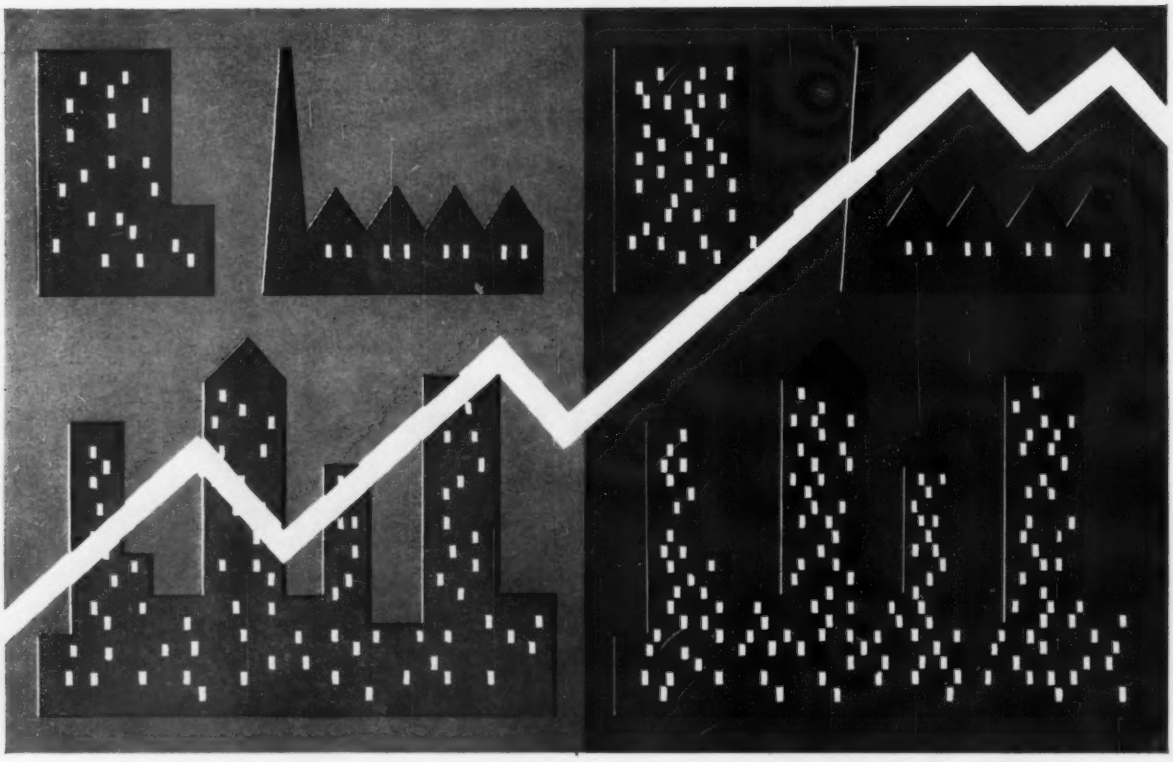

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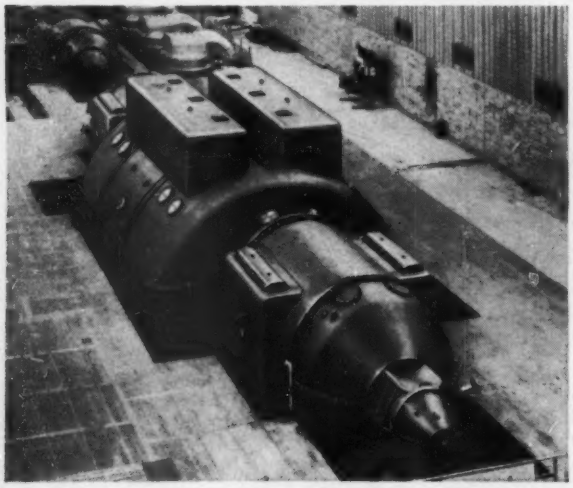

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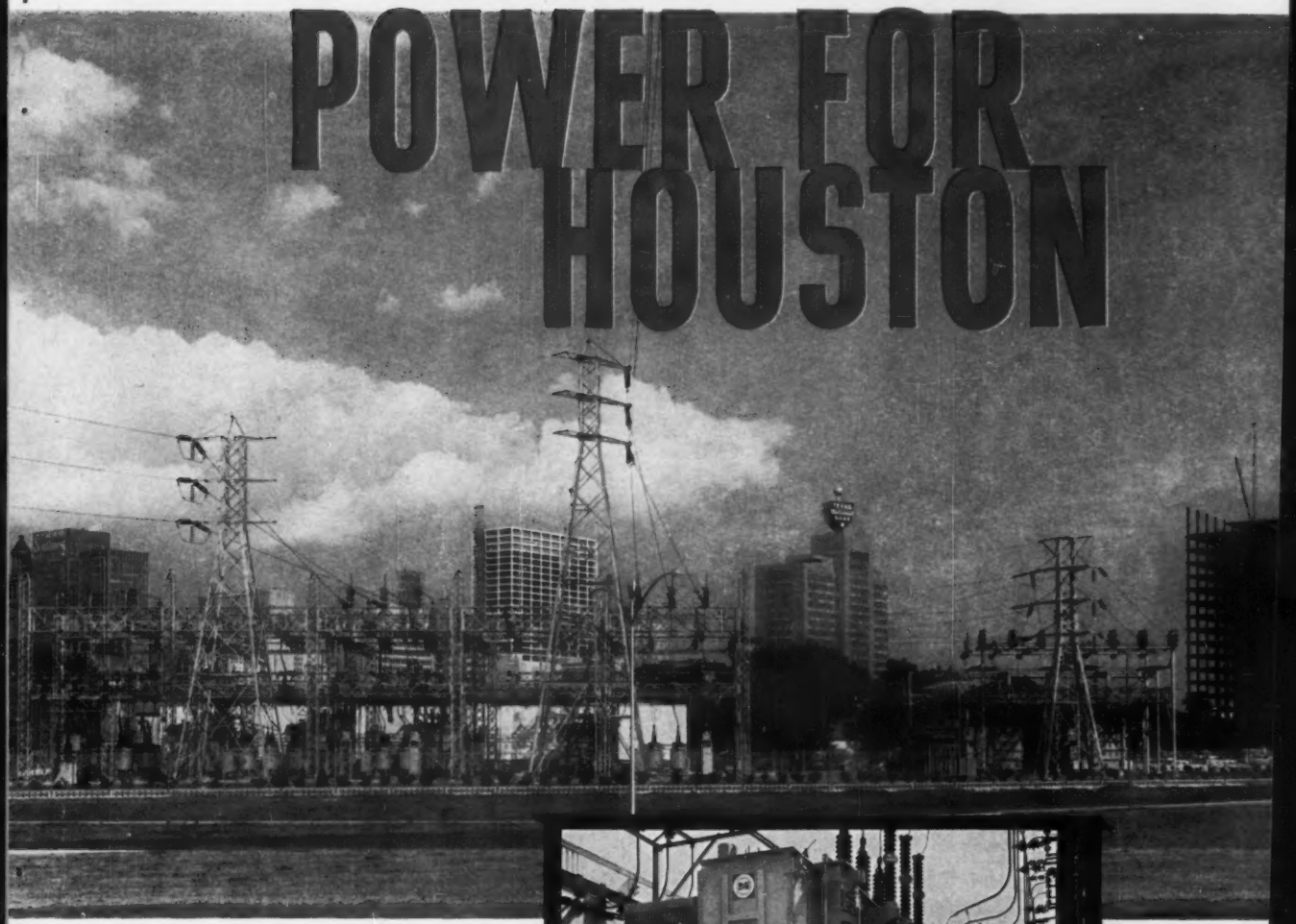

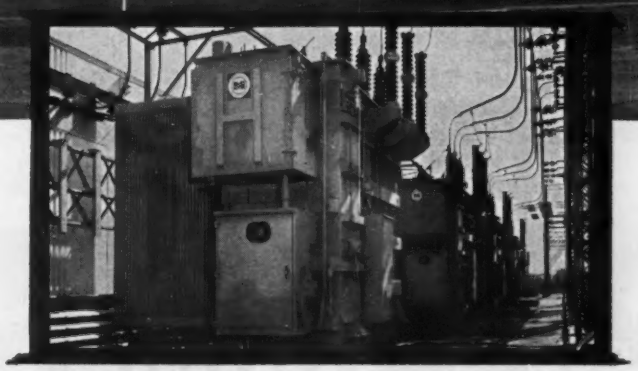

Closeup of Downtown Substation showing six 25,000 KVA, Moloney LTC Transformers.

ME61-5

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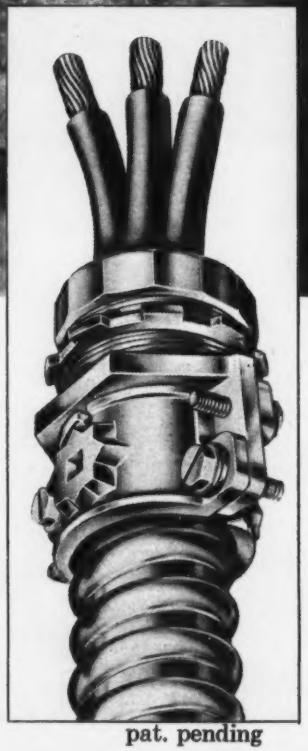

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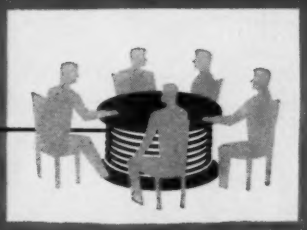

Over 20 years' exposure in Florida sun proves weather resistance of polyethylene for wire jackets

You have asked . . .

Q. Our test results on the dielectric constant and dissipation factor of your ALATHON polyethylene resins do not correlate with your published data. Can you resolve these differences?

A. Possibly our different values are due to a variance in test methods. We normally test the dielectric constant and dissipation factor of ALATHON resins by the benzene cell in our laboratories. Another reliable test uses the guarded-cell method. However, the guarded-cell method consistently gives higher dielectric constant values and slightly lower dissipation factors than the benzene cell. While both methods are ASTM-approved, we prefer the benzene cell despite some of the precautions required in handling benzene.

As an example, we tested five lots of weatherable ALATHON 4, BK-30 by both test methods. Following are the average dielectric constant and dissipation factor results at 10Kc. Please note that the values are for a carbon-filled polyethylene. A natural polyethylene would have superior electrical properties.

	Guarded Cell	Benzene Cell
Dielectric Constant	2.70	2.58
Dissipation Factor	0.0009	0.0012

Du Pont does not manufacture wire and cable, but supplies thermoplastic resins to the wire and cable industry.

(UNRETOUCHED PHOTO)

The segment of telephone wire being flexed in the photograph above is part of a Bell Telephone Laboratories test installation which has been exposed for over twenty years to Florida sunlight and weather. The wire, which was jacketed with a weather-resistant polyethylene resin, withstood this prolonged exposure with no significant adverse effect.

Newer formulations of Du Pont ALATHON polyethylene resins have shown over fifty years' weather resistance in accelerated tests. Today, high-molecular-weight polyethylene is the preferred jacketing material of many large utilities and industrial users.

Whether environmental conditions include intense sunlight or repeated exposure to ice and storm, jacketing of ALATHON provides the necessary weather resistance, stress crack resistance and abrasion resistance. Installation is easier, too—because cable jacketed with ALATHON is light, flexible and smooth. It offers you minimum maintenance, maximum service dependability.

For more information about the properties and advantages of wire and cable constructions with insulation and jacketing of ALATHON polyethylene resins, consult your supplier. Or write: Du Pont Company, Dept. EW-327, Room 2507A, Nemours Building, Wilmington 98, Delaware.

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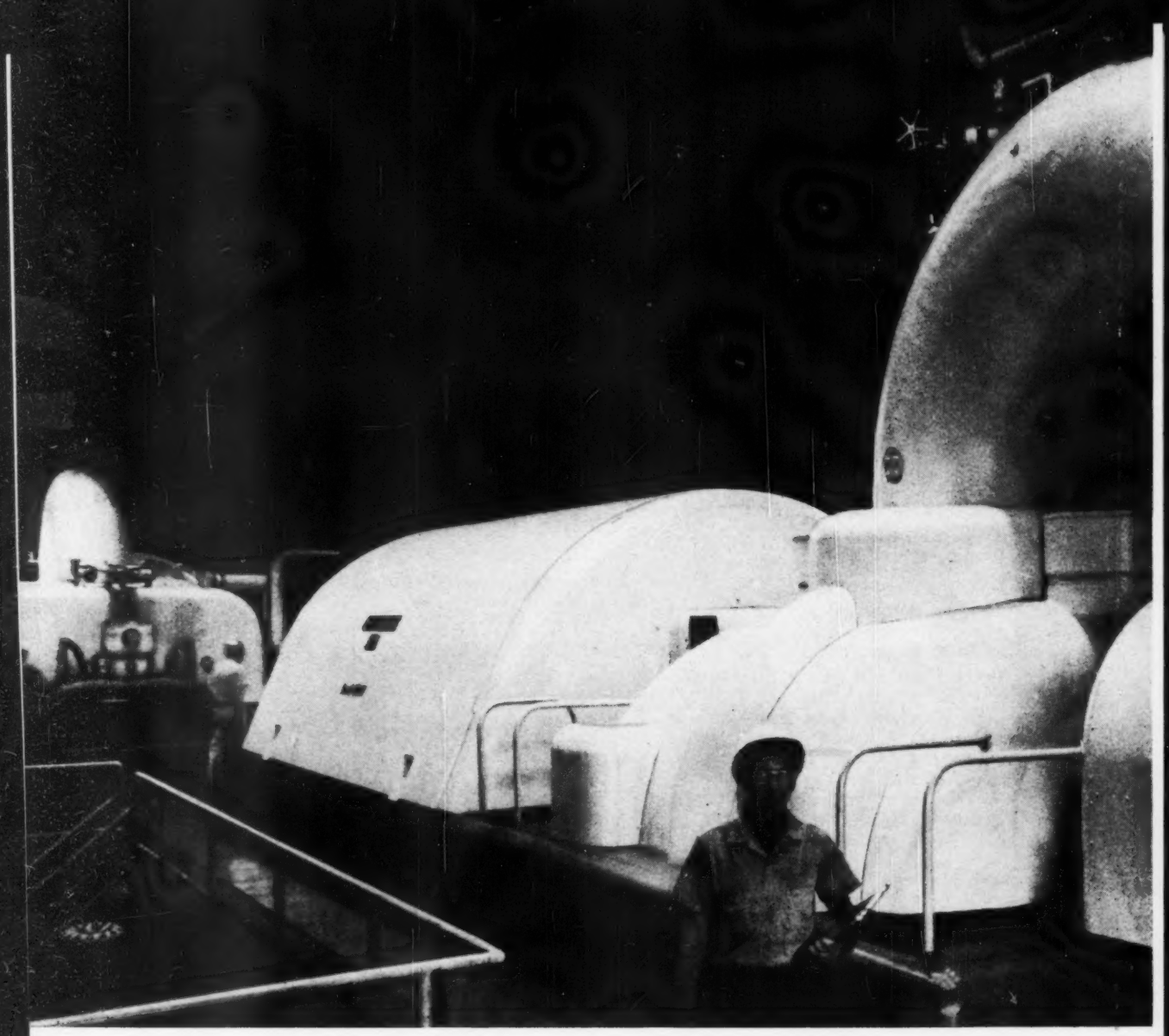


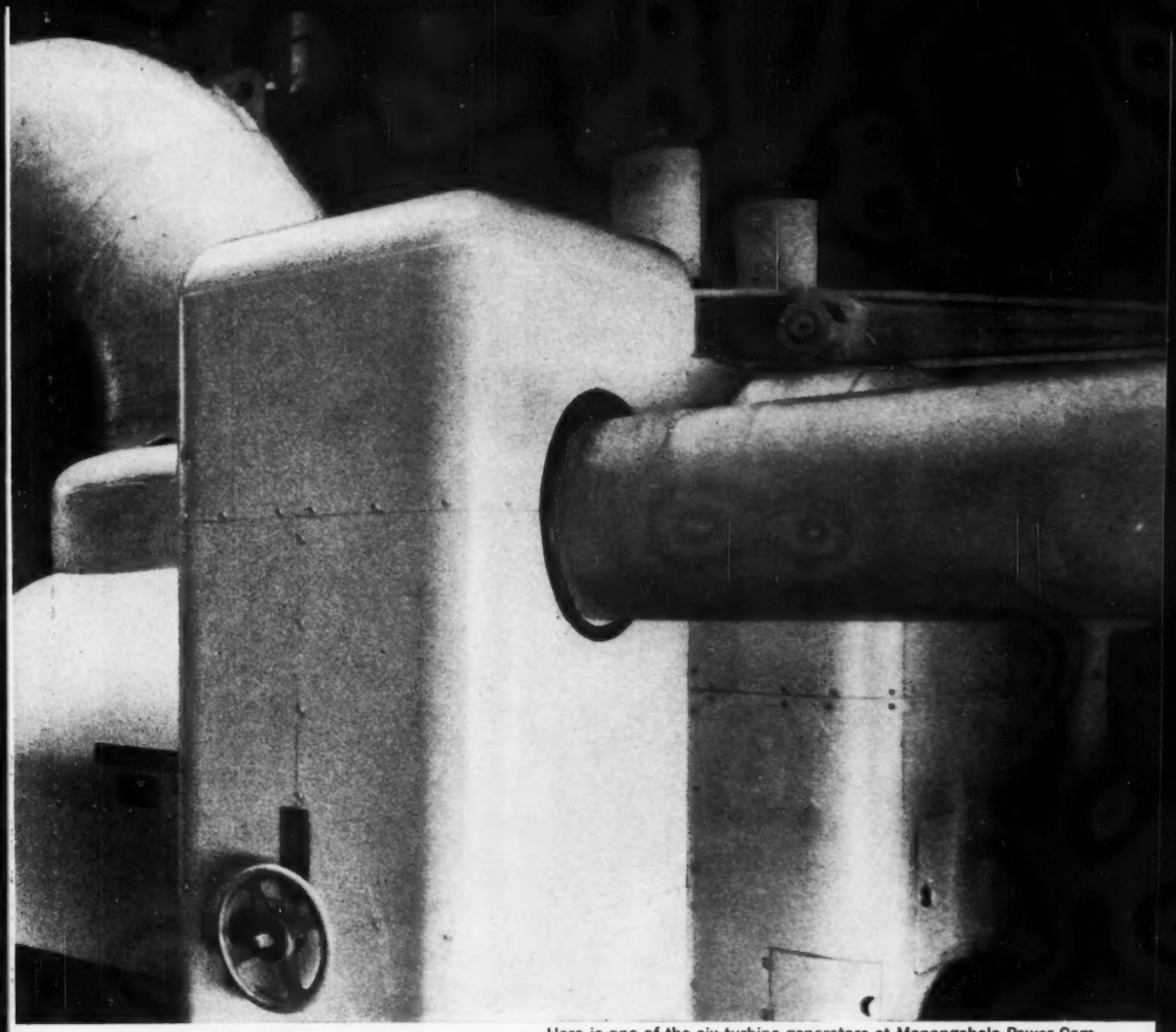
Gulfcrest® oil still on the job after thirty at Monongahela Power Company...

Thirty years ago, turbines at the Monongahela Power Company's Rivesville, W.Va., station were charged with Gulfcrest oil. For twenty-two of those thirty years, Walter W. Stahl, the plant's Chief Chemist has had an opportunity to carefully check the oil's performance.

Since the original turbines were put into operation, a lot of changes have taken place. The plant's power capacity has increased four-fold. New equipment, with higher speeds and greater output has introduced more critical lubrication requirements.

However, one thing hasn't changed much. That's the original turbine oil charge placed in a GE 25,000 kw steam turbine. This turbine generator was placed in operation one year before Mr. Stahl arrived at Rivesville. Now, twenty-three years later, the oil is remarkably close to its original specifications. Here's how the oil tested in 1960. Steam emulsion number, 230; Neutralization value, 0.03; Interfacial tension (dynes per cm at 77°F.), 31.5.

Because of this remarkable performance, this plant has used only one brand of turbine oil for thirty years—Gulfcrest. Mr. Stahl adds, "There has never been a bearing failure in any of the turbine



Here is one of the six turbine generators at Monongahela Power Company's Rivesville, W.Va., station. It's a 90,000 kw steam turbine. This station has used one brand of turbine oil exclusively for 30 years.

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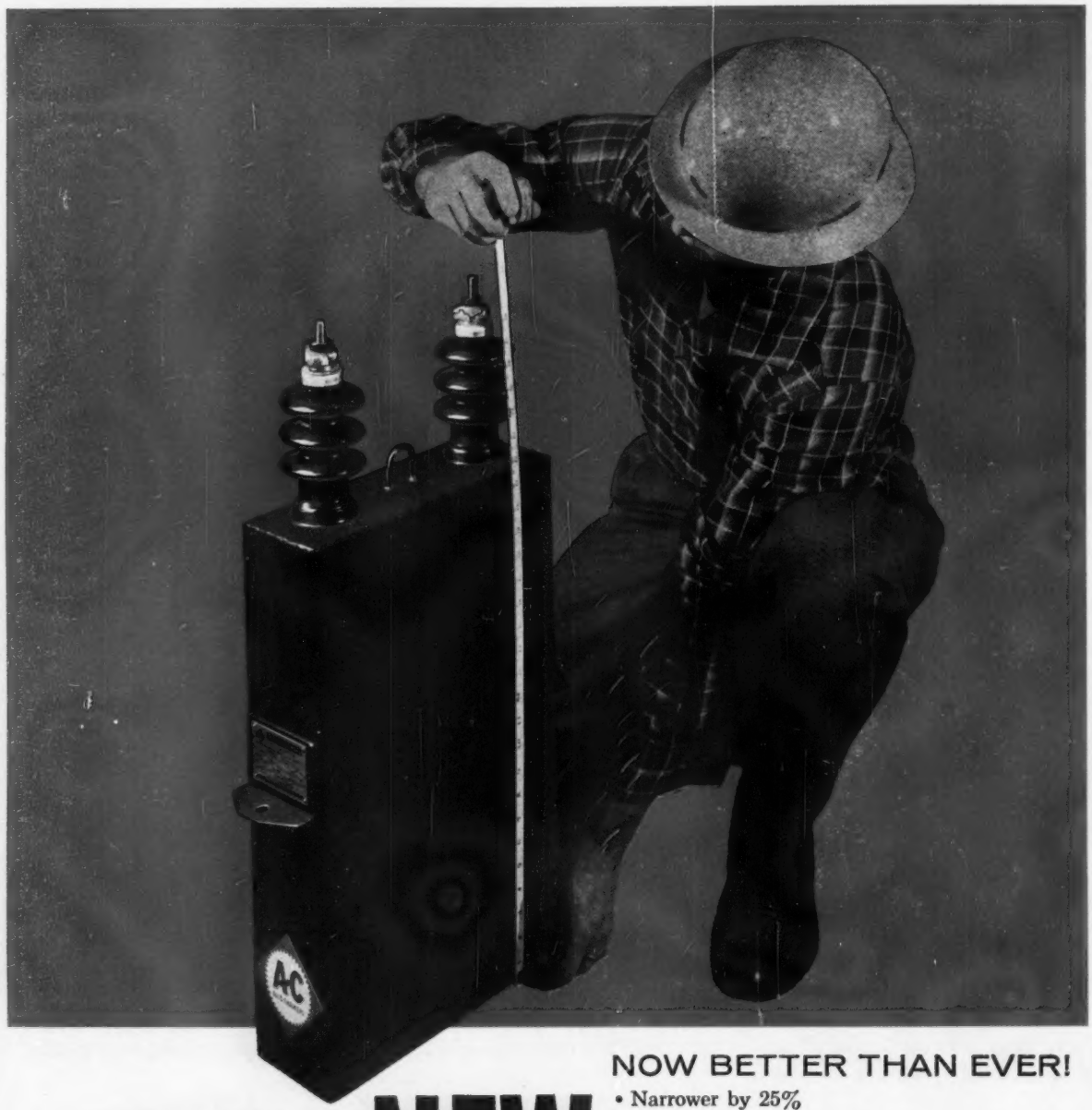
H. E. Schinkle, Gulf Sales Engineer (left), watches as Chief Chemist Stahl takes a sample of oil from the reservoir of a turbine lubrication system. Constant analysis proves Gulfcrest remains remarkably stable.



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Editorial Comment

MARCH 27, 1961

Prospects Brighten for EHV Standard Levels

At long last the necessary first steps have been taken leading to standardization of transmission voltages in the EHV range. Most recent of these is the action of ASA Sectional Committee C-92 in endorsing 345, 500, and 700 kv as proposed American Standard voltages, subject to the confirmation of a letter ballot.

This development comes some eight years after the first 330/345-kv transmission lines were placed in operation in the US and at a time when upwards of 2,600 circuit miles of such lines are in service. However, industry approval of 500 kv as the next step above 345 kv would appear to be in the nick of time to avoid future confusion.

Up to now some consideration has been given 460 kv as the next EHV step, following the historical pattern of even increments of 115 kv. This pattern, however, has the objection of imposing a declining percentage change between voltage steps and so increasing the number of steps. The growing acceptance of 500 kv, on the other hand, preserves a more appropriate ratio above the 345-kv level.

It is desirable that in these days of swiftly changing power system patterns that full approval of 500 kv come now, before planning and development at the 460 kv level has progressed beyond the point of ready adaptation to 500 kv. Although 460 kv is being used in some prototype lines for study purposes, extrapolation of findings to 500 kv is practicable and the choice between voltages is not yet hampered by equipment availability.

It is to be hoped that 345, 500 and 700-kv levels will be promptly endorsed by remaining standardization bodies as an American Standard and that they will find swift acceptance. Such prompt and decisive action will not only give new direction to the upward progress of power system development in this country but will solidify the wavering pattern of international voltage standardization around the world.

Pool Planning Should Be Publicized

The general concept of large power pools and strong interconnections seems to be accepted by all segments of the electric utility industry.

The investor-owned sector is strongly endorsing the basic principle, but its voice is not yet heard nationally above the clamor set up by proponents of non-investor power. Unless the companies publicize their plans and accomplishments with vigor, the public may be lead to assume that they have abdicated to aggressive public power interests.

Investor-utility spokesmen are beginning to attack this point. One of the clearest sentiments is expressed by E. M. Naughton, president, Utah Power & Light Co. UP&L is one of the companies doing an outstanding job in the pooling and interconnection area, and it has made an individually fine effort in getting the story over to the public at large.

According to Naughton, the past 30 years has seen the utility industry make giant strides in the transmission and integration of power facilities: "We have already accomplished much of the job that needs to be done."

But, as to the future: "I believe our industry should beat federal planners to the punch and construct every possible intercompany tie and organize and put in operation every practicable power pool before it is too late."

Naughton emphasizes strongly that planning activities, and actual construction to implement them, should be brought to the attention of the American public in order to offset irresponsible claims and statements by non-investor power advocates.

We could hardly agree more.

Pumped Storage Interest Brewing

SPA sees 10-million-kw potential in Southwest, with atom power for base load. Corps to survey reservoir potential

A broad-based program of federal pumped storage projects may be the next item on the program of public power developments, if off-stage rumblings in Washington and elsewhere are an indication of things to come. Audible almost since the new Administration and Congress sat down to work, the cues have been getting louder and more frequent in recent weeks. For example:

• From Washington, the Corps of Engineers was distributing a new "manual" on pumped storage principles to its field offices to familiarize them with pumped storage features and requirements.

• At the National Farmers Union convention recently Asst Interior Secretary Ken Holum earmarked pumped storage at federal reservoirs as "a federal responsibility" and prophesied that substantial development in new pumped storage plants can be expected as loads grow and larger quantities of peaking power are needed.

• On Capitol Hill, bills asking for a government study of pumped storage feasibility at all federal projects and of the terms on which nonfederal producers should be allowed to use federal reservoirs in pumped storage projects have been introduced by Reps Wayne Aspinall (D-Colo.), Chairman of the House Interior Committee, and Walter Rogers (D-Tex.), Chairman of the Reclamation Subcommittee.

• At the Dallas convention of the National Rural Electric Cooperative Assn last month, delegates hammered out a resolution urging Congress to make a comprehensive study of energy potential at federal reservoirs, set up laws for non-federal pumped storage projects, and assure that energy from projects at federal reservoirs be ruled by preference laws.

• In a closed session during the NRECA convention, Southwestern Power Administrator Douglas G. Wright, a long-time enthusiast for pumped storage, dubbed it as "the real giant of the power industry" and urged an immediate start on its development in a speech to the Advisory Committee on Power for the Southwest.

Behind the new wave of interest in pumped storage were a series of technical and political developments. For one thing, the growing number of pumped storage projects being announced by investor-owned utilities, notably Union Electric Co's Taum Sauk project, were being taken as evidence by public power enthusiasts that pumped storage was economically and technically feasible. Wright has repeatedly cited Taum Sauk as proof of this feasibility both in his NRECA speech and in testimony before the House Appropriations Committee.

In many Midwestern and Southwestern areas, most of the dam sites have already been utilized. Those that remain would have a higher cost per kw for peaking power than satellite pumped storage projects at existing reservoirs, according to the federal pumped storage spokesmen. And many of the existing federal reservoirs are in rugged terrain, such as the Appalachians, the Ozarks, the Rockies or the Sierra Nevada, where adjacent gullies, tributaries, or other depressions can conceivably be easily converted into pumped storage projects, using the existing reservoir as an afterbay.

Preference Is Concern

In addition, there is apparently concern among the federal and co-op power supporters that investor-owned utilities will pre-empt the best sites around existing reservoirs for power that would not be subject to preference requirements. So they are pressing for more federal regulation on these projects.

Finally, by assigning such pumped storage projects "an equitable share of the cost of federally-owned projects which make them possible," as the NRECA resolution urges, proponents of more federal multipurpose projects may hope to justify installations which would not otherwise be economic.

In the Corps manual, districts are asked to study reservoirs where a pump or pump generator could be used in the main dam and those using an auxiliary impoundment at a higher elevation. Specifically, the manual asks district offices to investigate and report potentialities at all Corps dams and also to report any other pumped storage proposals, presumably by non-federal groups, involving these dams. Evaluation of pumped storage at Corps projects will be used both to formulate federal projects and to analyze proposals made by non-federal groups. The House Appropriations Committee last year asked both the Corps and the Bureau of Reclamation to submit estimates of the cost of studying pumped storage potential at their dams.

According to the manual, projects now in the design stage could be changed to include integral pumped storage by the Chief of Engineers without additional authorization. But addition of satellite or adjoining pumped storage would probably require an okay from Congress.

Call 150-ft Head Adequate

In setting up criteria for evaluation of satellite projects, the Corps publication requires a head of at least 150 ft between the off-channel storage facility and the main reservoir level and stipulates a generation of about 1,400 kwhr per year as typical for peaking operation. It also assumes that three kwhr of pumping energy will be needed for each two kwhr of generation and that cost of a pump generator will be about 150% that of a conventional unit.

In a telephone interview with *Electrical World*, Wright claimed that the Southwestern Power Administration's 18 hydro installations (nine existing and nine under construction or planned) had a peaking potential of "at least 10 million kw and possibly 30 million." He emphasized that he was at present "only dreaming" and had no authority to proceed, although he has been pushing hard for pumped storage on the SPA projects for several years.

Speaking to the Advisory Committee on Power for the Southwest, Wright cited preliminary studies on Tenkiller Ferry Dam where he

in Congress, Interior, Co-ops

claimed a peaking potential of "possibly 2.5 million kw" could be developed at four sites (see map at lower left). The pumped storage potential would be developed by building small reservoirs—ranging from 8,500 to 14,800 acre-ft—in the hills around the existing reservoir which would serve as an afterbay. Such projects, claims Wright, could be feasible with heads as low as 250 ft. The cost, he said, may be below $200 per kw, which is less than estimated cost for the remaining run-of-river possibilities.

Wright, a veteran of 30 years in public power operations in Nebraska, Oklahoma, and the SPA, estimates that the Tenkiller project might operate about 1,200 hours per year, for a load factor of about 14%. Pumped storage on the Beaver project might be less than 1,000 hours per year.

Sees Atom Power as Adjunct

In his Dallas talk, Wright assumes an investment of three kwhr, at 3.5 mills per kwhr (fuel only) to produce two kwhr of peaking energy. This peaking energy could be sold for 18 mills per kwhr, he claims. And, he continues, representatives of several utilities in the SPA area have indicated that hydro capacity at a cost of $175 to $200 per kw can be economically utilized in their systems.

In addition to his studies at the Tenkiller site, Wright would like to study development of a 500-Mw pumped storage project at Buckhorn (see map), in combination with a 250-Mw atomic reactor to be operated for base load. SPA sells power from nine dams, with about 650-Mw capacity. The other nine, now in construction, total about 700 Mw.

Would Limit US Role

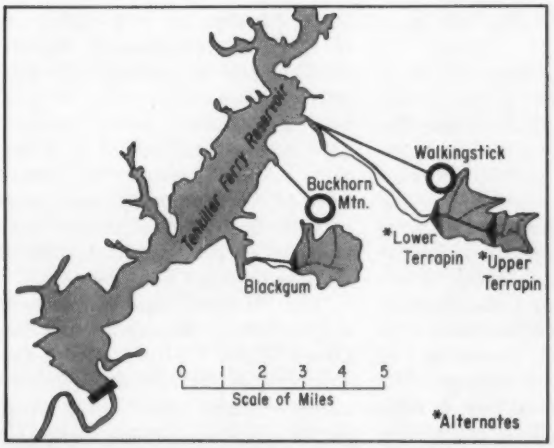
But despite his long career in public power, Wright believes that "the government's part in the program should be limited to an assistance in design, the leasing of a site, and so forth, and that the plants should be constructed by the people who have the thermal energy to store—whoever that may be." He maintains that "if the government did not get a fee of but 0.1 mill per kwhr for use of the site, the economics of every reservoir in the Southwest would be tremendously changed."

In his testimony before the House Appropriations Committee last year, he quoted "a leading hydraulic engineer in Tulsa" who had surveyed 1,000 sites—in Oklahoma, Texas, Kansas, Missouri, Arkansas, and Louisiana—which were capable of producing five million kw. The SPA serves some portion of all these states.

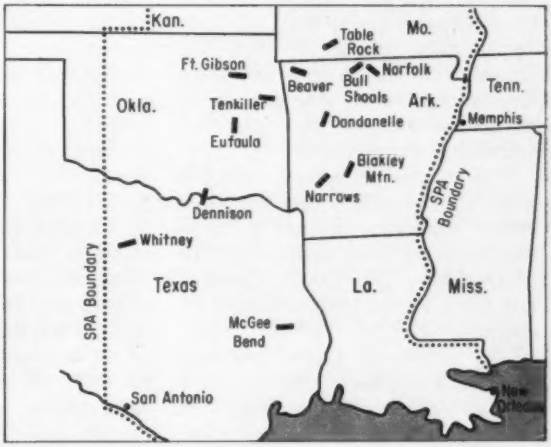
The reports which the House Appropriations Committee has requested from the Corps of Engineers and the Bureau of Reclamation—asking for estimates on the cost and possible locations of future pumped storage—will probably be kept under wraps for a while. Both will be considered when the Committee takes up the (fiscal) 1961 public works appropriation soon.

To date, few investor-owned utilities have proposed pumped storage projects involving federal reservoirs. One of the few is Public Service Co of Oklahoma, whose application for the 200-Mw Sand Creek pumped storage plant is currently before the Federal Power Commission. The lower pool in this scheme would be the big federal Keystone reservoir, across the Arkansas River from Tulsa. The deadline for filing intervenors' petitions expired Mar. 17, with no intervenors.

Two other proposed projects involve operating companies of the General Public Utilities system. One, on the Allegheny River in northern Pennsylvania, would be built by Pennsylvania Electric Co in cooperation with local electric cooperatives. The reservoir behind the proposed Kinzua Dam, now being built by the Corps of Engineers, would be used as part of this project. The second is a project on the Delaware River, which would use the proposed Tock's Island reservoir.



FOUR PUMPED STORAGE SITES at SPA's Tenkiller Ferry reservoir may have 2,500-Mw peaking potential



OTHER POSSIBLE PUMPED storage sites include SPA reservoirs shown above. SPA serves all or part of six states

Burns Creek Proposals Debated

Legislation to authorize the federal Burns Creek hydroelectric Project (about 90 Mw) on the Snake River, Ida., last week began its third run through Congress—this time in subcommittee hearings of both the Senate and the House of Representatives.

Last week's hearings differed noticeably in treatment by the Senate and House groups. The Senate Interior Subcommittee, under questioning by Sens Frank Church (D-Ida.), John Carroll (D-Colo.) and Clinton Anderson (D-N.M.), gave proponents of Burns Creek a lot of moral support, while indirectly slapping down comments by opposition witnesses. The House Interior Subcommittee, however, challenged proponents of the project on a number of issues, and indicated that its hearings would be lengthy.

A new recommendation in favor of Burns Creek by Interior Secretary Stewart Udall indicated the project would cost $45,430,000, exclusive of fish and wildlife features—the same price tag as that given for the project in January, 1959. One difference, however, is that Udall indicated a higher benefit-to-cost ratio for the project than heretofore mentioned. Over a 50-year period, Udall said the ratio would be 1.33-1; over a 100-year period it would be 1.63-1. Early ratios, for the same periods, respectively, were 1.19-1 and 1.4-1. The higher ratios were achieved by revising upward the value of power from the project without increasing construction cost.

Sen Church challenged data in a pamphlet of Utah Power & Light Co, called, "A $50-million White Elephant," opposing the project. Church questioned assistant Reclamation Commissioner N. B. Bennett Jr on a number of issues intended to refute the pamphlet's charges—that Burns Creek is uneconomical, not a reclamation project, would inundate more good land than it would reclaim, could not act as a re-regulation dam, would produce more expensive power than from a steam plant.

Criticizes Project

Sen Wallace Bennett (R-Utah), however, criticized the project on four grounds: **(1)** "It would deal a severe blow to the coal miners and to the entire coal mining industry of Utah and Wyoming," **(2)** "It is not a reclamation project, it is an unalloyed public power project," **(3)** "It is not needed . . . in fact, reclamation will actually be harmed" by it, **(4)** "It cannot pay its own way, in fact, Burns Creek power would cost $500 per kw, compared to Palisades' (dam) $185 per kw."

The House Interior Subcommittee differed in atmosphere. Rep Gracie Pfost (D-Ida.) a long-time supporter of the measure, remained almost silent, while Reps John Saylor (R-Pa.), James Haley (D-Fla.) and Odin Langen (R-Minn.) blasted Burns Creek supporters.

Fight Looms on Missouri Water Use

A battle is brewing between preference power users and the Corps of Engineers over water use in the Missouri River Basin.

Senate Majority Leader Mike Mansfield (D-Mont.) and two other senators, Lee Metcalf (D-Mont.) and Quentin Burdick (D-N. D.), have written President Kennedy, asking him to: **(1)** "Order a halt to the unwise and improper management and release of Missouri Basin water" by the Corps, and **(2)** To enforce the provisions of the O'Mahoney-Milliken amendment to the 1944 Flood Control Act, which defines the use of water between the Corps and the Bureau of Reclamation.

The O'Mahoney-Milliken amendment, claim the three senators, requires that river water should be used to "fully meet the beneficial, consumptive uses" of the 17 reclamation states, before the water can be used for navigation. The three senators claim the Corps has "persistently refused to obey" the amendment, and have operated its reservoirs so as to give priority to navigation over energy and reservoir-filling requirements.

The Corps disagrees violently with this position, arguing that power generation is not a "consumptive use," as defined by the amendment. The Corps claims it has lived up fully to its legal requirements.

The Missouri Basin problems have been aggravated because of a number of low-water years, in which all uses have been cut back. In addition, power demands of preference customers in the Basin are now requiring all the power available from the main-stem power plants, operated by the Bureau. At power allocation hearings, held by the Senate Interior Committee a couple of years ago, preference customer spokesmen claimed that 600 Mw of firm capacity was lost on the main-stem dams—Fort Peck, Garrison, Fort Randall—because of water requirements to maintain navigation levels.

The 1961 "navigation season" began Mar. 23, under agreement of the Missouri Basin Coordinating Committee, and this will require water use through early autumn, when the navigation season ceases.

The coordinating committee was meeting in Omaha last week, as *Electrical World* went to press, and the charges were certain to flare up there. Some critics of the preference users' charges claim that they are using the navigation issue as a stepping-stone toward higher priority for power at federal multipurpose projects.

Assistant Interior Secretary Kenneth Holum struck at the Corps indirectly in a speech before the National Farmers Union in Washington, D.C. He said the Missouri River Basin "has been aggravated by wasteful practices and lack of planning and imagination in the management of the Missouri River Project and its water. As a result, farmers and townspeople there have been deprived of thousands of kilowatts of electric energy. Because power revenues pay a large portion of irrigation costs, the irrigation program may be seriously handicapped."

Asks Delay on Snake Hearings

Delay would push construction start back to about 1965—the year Pacific Northwest Power Co anticipates shortage

A three to four-year delay in the Federal Power Commission's approval of a license for either of the rival Nez Perce or High Mountain Sheep projects has been recommended by Interior Secretary Stewart Udall in a letter to FPC Chairman Jerome Kuykendall.

Udall's recommendation would have the effect of throwing out the window all the present financial, power marketing and fish conservation testimony presented by the two rival applicants, Pacific Northwest Power Co and Washington Public Power Supply System.

Whether the Commission will go along with the delay hasn't been decided. The FPC has, in the past, ignored some requests by the Department. Actually, the full Commission won't have to decide the issue for a few weeks. Hearings on migratory fish problems at the two sites are underway now in Portland, Ore., and an Apr. 10 hearing has been set for Washington, D.C., to hear final rebuttals. Udall wrote Kuykendall separately that he didn't want to interrupt the hearings —they could be completed.

More Fish Studies Needed

Udall's delay would be to permit the Department to conduct an attack on fish passage facilities: "With the concurrence of the President, the Department has decided upon a crash program to try to find the answers, and will shortly request from Congress the necessary funds to finance this (study) program."

The end of 1964 was set as a target for completion of the Interior fish study. He added that, "pending completion of the accelerated fish studies, it would serve no useful purpose for personnel of the Department to appear as witnesses in the pending proceedings. We are, therefore, recalling permission heretofore granted, for them to appear as witnesses."

Robinson Objects to Delay

Reaction came swiftly from Kinsey M. Robinson, board chairman of Pacific Northwest Power. He called Udall's request "a threat to Northwest construction jobs and orderly power development."

Robinson added, "PNP has spent a substantial amount of time and money proving that High Mountain Sheep can be built immediately while keeping the Salmon River completely open for fish runs. Meanwhile, study of the fishery problem on the Salmon River can be continued for as many years as necessary, be it four years or 20 years.

"Secretary Udall's proposal to withdraw technical fish witnesses of the US Fish & Wildlife Service from FPC hearings seems clearly at odds with his responsibility to give the FPC information it should have about the fisheries resources.

Washington Public Power Supply System, concerned also over the 1964 target date for solving the fish passage problem, was more optimistic than PNP that it could be solved sooner.

Hurd Is Optimistic on Studies

Owen W. Hurd, managing director of WPPSS, said a letter from James K. Carr, Undersecretary of Interior, indicates clearly to WPPSS that the 1964 date "does not preclude an earlier solution to the problem. We are confident that the crash program of research and testing proposed by the Department of Interior will confirm the merits of our proposal for fish passage facilities at the Nez Perce project," Hurd stated. He hopes for an early solution.

Divided AEC Authority Recommended

A staff study made by the joint Senate-House Atomic Energy Committee has recommended that safety-regulatory responsibilities now vested in the Atomic Energy Commission should be divorced from promotional functions. The dual role shared by AEC of promoting the commercial uses of atomic energy is so great, the report found, that there is danger that public safety may be sacrificed in conflicting cases.

Harvard Law School's David F. Cavers and former AEC General Counsel William Mitchell assisted as consultants to the Committee's staff in preparation of the study. The conclusions and recommendations—not yet approved by the 18 committee members—will be used as the basis of hearings on safety control problems regarding nuclear power and commercial atomic uses this spring.

Safety regulation of the industrial uses of radioactive materials, once separated from AEC, could be placed under an independent safety and licensing board, the study found. The board would be composed of three presidential appointees: two high caliber technical experts on commercial nuclear power and a skilled administrator who would probably act as the board's chairman. The board would be set up within AEC, and would have the final say on all nuclear safety matters, including the licensing of private reactor facilities. Present AEC commissioners would continue to direct operations of the Commission's $7.5-billion physical plant and 120,000 employees. The separate licensing board would also have the power to recommend standards and basic safety rules for the nuclear industry.

Exactly how far the new proposals will get is debatable, however. A recent press conference remark by the President could affect a fundamental re-tailoring of AEC's present organization. After discussions with AEC officials, Kennedy said there is now adequate separation between the two functions for them to work out satisfactorily under present organizational arrangements. They result in a "fair balance today," Kennedy said.

Plans for 580-Mw Unit Announced

Though not the first, sequence of reheat stages is unusual, going 25F higher in two progressive steps

Plans to add a 580-Mw, $73-million turbine-generation unit to the Tanners Creek Plant of the Indiana & Michigan Electric Co at Lawrence, Ind., on the Ohio River, were announced in mid-March at a joint press conference conducted by Indiana's Gov Matthew E. Welsh and R. E. Doyle Jr, vice president and general manager of I&M, a major operating company of the American Electric Power System.

Largest and Most Efficient

The unit is described as the largest and most efficient steam electric generating unit to be installed by an investor-owned utility.

The unit is being designed to operate at a net heat rate of about 8,500 Btu per kwhr and is expected to burn about 1,600,000 tons of coal annually. The new facility will be the fourth at Tanners Creek and will raise that station's total generating capability to 1,105 Mw. When completed in the spring of 1964, only one investor-owned utility power plant will be larger: the 1,300-Mw Clifty Creek plant of the Indiana-Kentucky Electric Corp.

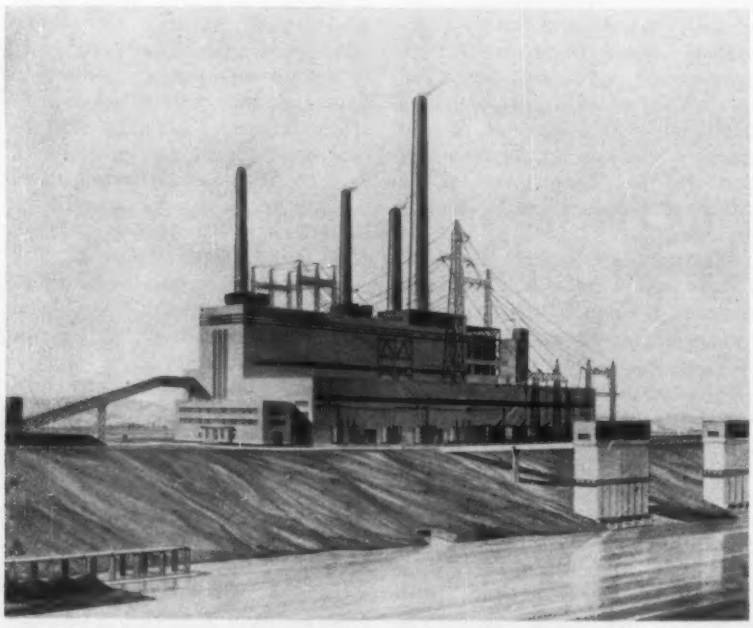
Steam conditions will be 3,500 psi with 1,000F initial heat, 1,025 first reheat, and 1,050 second reheat.

In announcing the Tanners Creek unit, Doyle said that growth of company power requirements, as well as those of the AEP System—coupled with the recently announced 30-year interconnection agreement providing for an exchange of power between I&M and Indianapolis Power & Light Co (EW, Feb. 27, p 69)—led to the decision to begin construction of the new facility at Tanners Creek. Construction will begin this summer.

Plans call for construction of 186 circuit miles of 345-kv transmission line and necessary substation facilities at an additional cost of over $12 million, Doyle said. These new lines will route the additional capacity from Tanners Creek into the I&M system and in turn into the balance of the AEP System, as well as into the Indianapolis area. I&M today operates a backbone transmission network totaling almost 700 circuit miles of 345-kv lines.

Completion of the Tanners Creek addition will increase the company's generating capability to more than 2 million kw and that of the entire AEP System to more than 8 million kw.

Tanners Creek's first two units, each with a capacity of 155 Mw were placed in operation in 1951-52; its 215-Mw third unit went in service in 1954.



FOURTH UNIT FOR TANNERS CREEK of 580 Mw will bring capability of station to 1,105 Mw in 1964. Among power company plants, only IKEC's Clifty Creek will be bigger with 1,300 Mw

Bonneville Reorganizes For Big Marketing Push

Bonneville Power Administrator Charles F. Luce has shifted BPA organization to put the federal power agency back in the power promotion picture.

Principal change was creation of a new division of power management. All functions relating to power marketing, resource planning and system operations are grouped in the new division.

Luce named Bernard Goldhammer acting power manager. He has been BPA's commercial operations officer.

The new division was given primary responsibility for increasing BPA's power sales to boost present revenues, expanding use of industrial power and to hold the line on the agency's rates.

"Bonneville Power Administration's reorganization seeks to create an action agency instead of a holding operation," Luce said. "BPA can and must play a vital role in power development of the Northwest as well as contribute to economic development to meet current and long range needs of the region."

The reorganization also placed maintenance and plant service functions under the division of engineering headed by E. C. Starr, chief engineer. Area offices of BPA in Portland, Spokane and Seattle were made responsible directly to the administrator's office.

News Scope

AREA DISPUTE—Montana Power Co has filed a petition with the Federal Power Commission to intervene in the application of the Salish and Kootenai Indians for a preliminary permit at Buffalo Rapids dam sites. The utility has filed an application to build dams in the same area. Montana Power claims that, if the Indians' permit is granted, it will be forced to seek other supply sources and postpone indefinitely any further development in that area of Flathead River.

SUSPENDED—Scoring the Indiana Statewide Rural Electric Cooperative for its "over-emphasis on government ownership," the Indiana Farm Bureau recently dropped the co-op from its family of organizations. The Bureau saw an "unnatural trend to veer away from Farm Bureau, its thinking and its philosophy, toward an independent uncharted course of over-emphasis on government ownership." The suspension followed the action by the co-op giving more power to its general manager and indicating that Farm Bureau representatives would no longer be welcome at meetings of the co-op's board of directors.

PLAN PACT—A pact for common interchange of electric power will be discussed at a May meeting in El Salvador of the Committee of Economic Unification of Central America. The Committee consists of the Ministers of Economy of El Salvador, Guatemala, Honduras, Nicaragua, and Costa Rica. The pact, which will probably be a protocol to existing common-market treaties, would cover electric interchange in border areas, where the country could not provide such energy itself. Informal discussions took place in Guatemala City.

FLORIDA HASSLE — Governor Farris Bryant has collided head-on with Florida power companies over his proposal to double a 1.5% state gross receipts tax. The tax, assessed against all regulated public utilities, is passed on to consumers because it is figured into their base rates. But investor-owned, municipal, and REA power groups declared they would present a solid front against the proposal when it comes before the state legislature at its biennial session which starts April 4. Gov Bryant, presenting his proposal before the State Assn of County Commissioners earlier this month, estimated that the hike would bring in an additional $10 million a year, which would be used to relieve counties of the burden of purchasing highway rights-of-way. The state would take over all such purchases.

Dateline . . . Washington, D. C. (*Continued from page 5*)

siderable pressure on the Interior Department to see that new markets are developed for Pacific Northwest power. To Interior, these markets might just as well be in California as in the Columbia Basin.

The follow-up on the treaty also brings into bolder relief the proposed Libby project as well as the contest between the High Mountain Sheep and the Nez Perce projects. Assured markets must be provided for them as well as for the additional prime power that would become available from the Canadian storage projects provided by the treaty.

First crucial test for power policies of the "New Frontier" Administration may come at hearings on the Interior appropriations bill this year. At that time the Administration will probably put up a stiff fight for funds to begin the proposed federal transmission network on the Upper Colorado. The five investor-owned utilities in the area already have their plans in order for such a network.

The issue has been pretty clearly drawn. It comes down to the relative costs of the two systems. The federal government has the advantage of low-interest financing and tax-free operations. It will be up to Congress to decide how much leeway will be given the federal government in building huge transmission systems. Outcome of this test may have a telling influence on other federal plans to expand federal grids.

In still another area of policy and effort, the "New Frontier" Administration will be feeling its way on pumped storage projects. The technical guidelines offered by the Army Corps of Engineers and the broad suggestions of the Southwestern Power Administration are setting the stage. In those areas of the country where much of the mainstream hydro potential is already under development, the pumped-storage proposals would seem to open the way for another broad field of federal endeavor. There is little doubt but that the Kennedy Administration will be pushing for federal development of the pumped-storage sites.

Again the question comes: How will Congress look at these efforts? Already Congressional committees have requested information on the cost of preliminary studies for pumped-storage projects. The Corps of Engineers' guidelines is one result of those requests. The addition of pumped-storage projects on reservoirs would probably increase the power benefits of some of the projects.

The question on pumped storage is not whether the federal government will attempt to get more heavily into this field, but when it will choose to make its fight.

The Kennedy Administration budget review, which was to go to Congress last week, would spell out more clearly the timetable for some of these efforts. Previous policy statements had already announced the intentions.

Insulation and Radio Influence Dictate Design of 650-Kv Substation

P. A. **ABETTI**, Manager, Project EHV, General Electric Co, Pittsfield, Mass.

The 650-kv North Substation of Project EHV is marked by three unusual features which differentiate it from the more familiar 230 and 345-kv substations.

First, the sheer size of the apparatus, structures, and busses is striking. Second is the amount of insulation. As represented by insulators and bushings it is proportionally much larger than in lower voltage substations. Third is the absence of sharp protrusions or angles anywhere in the substation, even on the roof of the house where corona loss is measured. Shielding is evident everywhere in the circles or ovals of smooth aluminum tubing.

These characteristics are dictated by the over-all criteria which were applied to this substation, and to the South Substation, which is to be completed by June 1961. Design criteria are fundamentally the same as a utility building an actual substation for 750 kv would use, but are modified by the required special instrumentation. Five design criteria are:

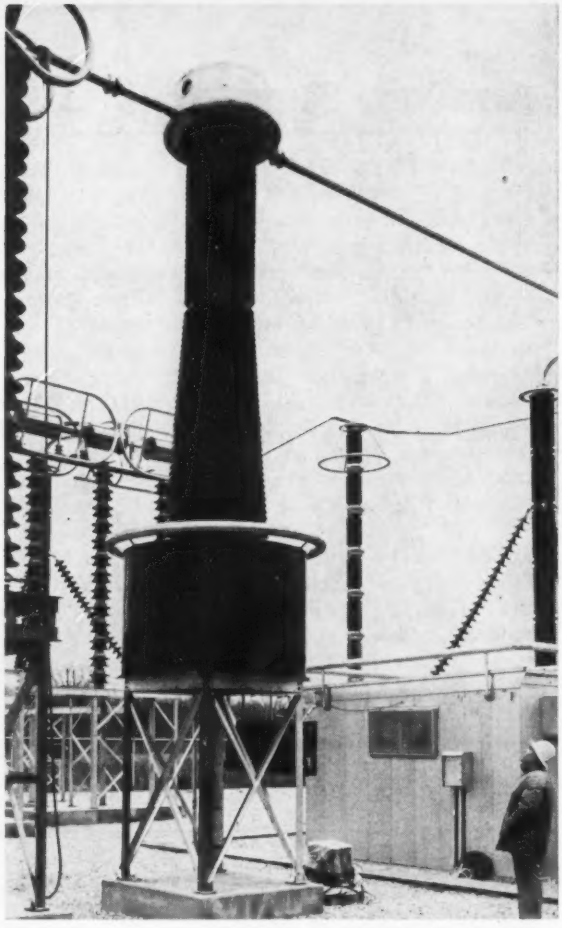
1. The substations include prototypes of apparatus which will be used by utilities to transmit large blocks of power at extra-high voltages.

2. The structures and busses are representative of designs for 460 kv and higher voltages. At present both rigid and strain busses are being used for 345-kv substations, and both may be used at higher voltages. Consequently, rigid aluminum bus has been used for the North Substation, and strain bus of bundled ACSR conductors for the South Substation.

3. Radio interference from the station is negligible compared to that generated by the line itself. The requirement that the great majority of corona pulses originate on the line and not in the stations is definitely more stringent than would be used by a utility and is desired for theoretical and practical reasons.

4. Station insulation requirements are established by lightning and switching surges rather than by 60-cps voltages or overvoltages since there are no insulator pollution problems in the Berkshires. However, greater distance between phases than required by insulation needs had to be used at times because of the special instrumentation for measuring corona loss.

5. Mechanical design criteria require that the structures withstand the severe weather conditions of the area, but that at the same time they be easy to erect, despite their large dimensions.



Radio noise from the busses is controlled by using either single tubes of large diameter or several conductors in a bundle, avoiding sharp corners, and using smooth and clean surfaces. For the North Substation, 4½-in. OD aluminum tubing was chosen by calculating the gradients, corona starting voltage, and radio-noise generation according to the theory developed by Dr Adams.

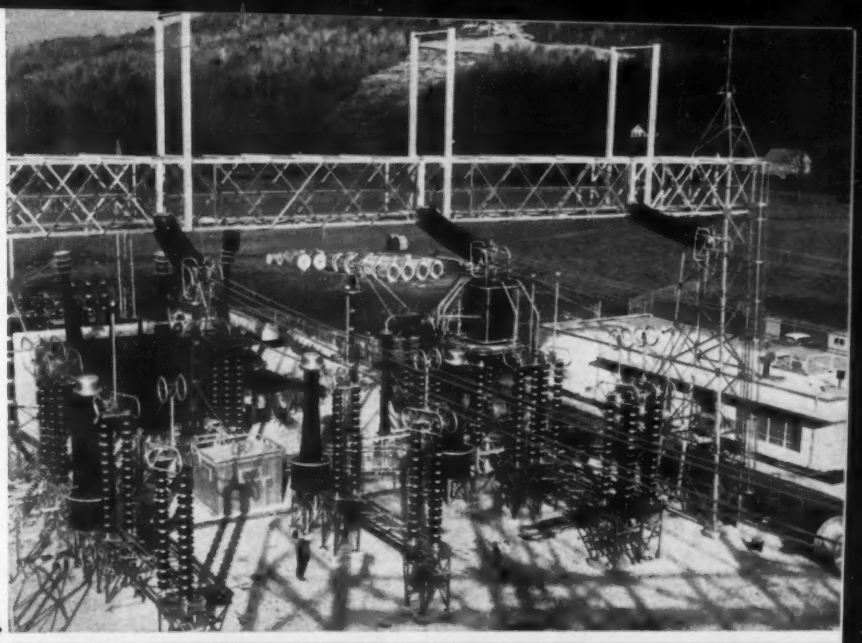
In the South Substation, strain busses consisting of four "Plover" conductors (1.465 in., 1,431 MCM) per phase, in a square with sides of 10 in. will be used. This spacing is considerably lower than the 16 or 18 in. which are normally used for EHV lines and is about the value which correseponds to minimum gradient.

Spacing Is Compromise

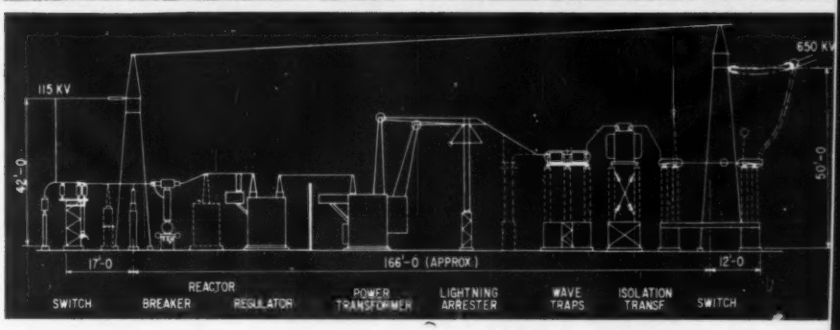
The spacing between bundle conductors of EHV lines is a compromise between gradient considerations which require lower spacings, and by reactance and mechanical considerations which require larger spacings. In a station, spans are short and mechanical requirements not so important. Bus reactance is negligible with respect to transformer and generator reactances. Consequently, it is expedient to use 7 to 12-in. spacings to minimize corona loss and radio noise. The radio interference voltage level is reduced by a factor of at least 10 to 1 because of the lower interphase spacing.

Sharp corners have been avoided by shielding all

Switching surges govern insulation requirements; corona rings, large diameter tubes, bundled conductors, smooth surfaces, and avoidance of sharp corners control radio noise



HUGE AMOUNTS OF PORCELAIN and sheer size of apparatus make men in substation appear as midgets. The drawing identifies equipment in photo



GAS-FILLED 650-kv capacitor shows porcelain required with EHV. Extensive shielding by aluminum tubing is evident

apparatus with corona rings of 3½ in. outer diameter. The corona loss instrument building in the center of the 650-kv North Station has been shielded by 4½ in. tubing.

Average conducted radio interference from each source was required to be 250 microvolts (μv) and maximum was to be 500 μv, at rated voltage plus 10%, equal 712 kv to ground. These values are considerably less than customary in existing EHV stations or permitted by applicable standards. Since radio noise generated by apparatus adds up as the square root of the number of sources, and there are about 16 sources in each station, the total RIV will be no more than 1,000 μv. Propagated without attenuation to the line, a radiated radio-interference level of only a few μv per meter at 100 ft from the outer conductor would result.

Calculated RI levels from the conductor vary between 30 and 70 μv per meter, and consequently the contribution from the stations will be negligible. In addition, RI filters in each station are tuned to give at least 40 db attenuation in the frequency range at which most RI will be measured. These filters prevent transmission of radio noise in both directions: From substations to EHV line, and from EHV line to substations and to Western Massachusetts Electric's 115-kv lines.

The line has been designed with horizontal configuration and two ground wires to provide maximum ability to withstand lightning. The line switching-surge strength is based on a maximum switching-surge amplitude of 2.4 to 2.5 times crest of normal 60-cps voltage. For modern air-blast breakers, restrikes rarely occur and it becomes practical to design insulation on a no-restrike level. Tests performed in the Pittsfield High-Voltage Laboratory showed that the wet-switching-surge strengths of insulation were lower than generally assumed, and approached the 60-cps strength. Consequently, switching surges are the critical factor in determining the line and station insulation.

Insulated Above Arrester Voltages

The station insulation, wherever protected by lightning arresters, is a reasonable margin above the lightning arrester voltages. Since there are no arresters available for 650-kv systems, the arrester sparkover and IR voltages in the table were specified for a 516-kv arrester. Station insulation was designed so that these voltages would not be exceeded when the arrester will be tested.

The 516-kv arrester and the 360-kv arrester to be used during operation at 460-500-kv are approximately 75% arresters, and are used because the system overvoltages likely to develop on the unfaulted phases during fault conditions do not exceed 130% of operating voltage. In the table, the impulse voltage of the arrester used for coordination is the IR drop at 20 kiloamps. Because of the lower surge impedance of the incoming 650-kv bundle conductor lines (285 ohms with three conductors per phase, 270 ohms with four),

the arrester surge current is proportionally higher than on single conductor lines, and therefore 20 kiloamps were used instead of the customary 10 kiloamps.

Transformer BIL Is Three Steps Down

The transformer switching-surge withstand level was set conservatively at 80% of the impulse BIL, and the minimum transformer insulation margins over lightning arrester voltages were set at 20% for impulse and 15% for switching surges. The resulting BIL of the high-voltage winding of the transformer is 1,925 kv, about "three steps down" according to the usual definitions of BIL levels in full steps of 250 kv. Most of the apparatus on the high-voltage bus was assigned a BIL of 2,050 kv in order to protect it by the high-voltage transformer arrester, taking into account the separation distance from the arrester.

The dry critical flashover voltage of the high-voltage bus insulation was selected to be about equal to the 650-kv insulation, 2,400 kv. Laboratory tests showed that a stack of 13 14½-in. pedestal units, 15.8 ft high, will meet this requirement. Rainfall has a pronounced effect on the impulse strength, and the wet impulse critical sparkover of the bus insulation is about 2,000 kv. The critical switching-surge strength of the bus insulation is about 21% higher than the arrester sparkover voltage. Considering contamination and other factors, this margin approaches the minimal. However, an increase in the length of the bus supports by adding more pedestal units would be accompanied by a decrease in mechanical strength, already taxed by the weight of the experimental apparatus attached to the busses.

Insulation of 650-Kv Section of Project EHV North Station

Characteristics of EHV arrester	
Lightning arrester rating	516 kv
Required minimum ASA 60-cps sparkover, crest	1,094 kv
ASA front of wave sparkover, max	1,460 kv
1.5 x 40 μsec. impulse sparkover, max	1,250 kv
Impulse kv at 20 ka arrester current, max	1,560 kv
Sixty cycle and switching sparkover, crest max	1,277 kv
Transformer	
Impulse BIL	1,925 kv
Impulse margin above lightning arrester*	23%
Switching surge withstand	1,540 kv
Switching surge margin above arrester	21%
Low-frequency test	860 kv
Bus Insulators	
Number of 14½-in. pedestal insulator units.	13
Length of pedestal stack	15.8 ft
Wet critical sparkover at standard air density	
Impulse, positive	2,000 kv
Negative switching surge (100 x 3,200 μsec)	1,550 kv
Dry critical sparkover at standard air density	
Impulse, positive	2,500 kv
Number of 5¾ in. string insulators	30-34
Live metal to ground, spacing	15 ft
Minimum spacing between phases	22.5 ft
Recommended minimum gap spacing of air disconnect switch	17.5 ft

• Margin at 20 ka arrester current.

The table includes the impulse, switching-surge, and 60-cps strengths of the 650-kv station insulation. Wet switching-surge strength is the controlling factor in the station insulation coordination, since it presents the lowest margin for transformer and bus insulators.

Direct stroke protection is provided by wires which crisscross the substation from peaks on the columns of portal-type towers at each end of the station. The shield wires are 159 MCM, ACSR 12/7, strung to a maximum tension of 2,000 lb under loading of 1-in. ice plus an 8-lb wind.

Grounding Limits Potentials to Safe Values

The main ground grid is parallel 2/0 stranded copper conductors about 25 ft apart. These are bonded to two periphery conductors which run parallel to the fence, one conductor three ft inside and the other three ft outside the fence. A ground conductor was buried around all electrical equipment and supports about three ft from the metal parts, and bonded to the main grid. At disconnecting switch locations, a copper mesh was buried directly below the operating handles. About 10,500 ft of conductor for the ground grid was buried about 15 in. below the finished substation grade. The electrical equipment, fencing, water pipes, and supports, and metal roof of the control house were connected to the ground grid. A 6-in. layer of crushed rock was placed over the area to about 5 ft outside the fence.

Assuming a time of 0.5 sec for fault duration and a soil resistivity of 1,000 ohm/meters, calculations show that the maximum touch potential that could exist in the substation is 750 v and the maximum step potential is 552 v. The calculated tolerable touch potential is 1,310 v and the tolerable step potential is 4,480 v.

Another unusual design feature is a mesh-enclosed walkway from the fence to the corona measuring building in the center of the station. The electric field under the 650-kv busses, which are about 23 ft above the ground, was calculated to be hazardous or disturbing to persons walking in the station. Consequently, it was decided not to let anybody into the energized 650-kv yard until appropriate measurements of voltages and currents have been made.

Lab and Field Tests Were Made

In order to design the 650-kv apparatus and substations for the project and to prove the adequacy of the design, three series of tests were made:

1. Insulation and radio noise tests in the laboratory to gain fundamental knowledge on the effect of the various design parameters.

2. Insulation and radio noise tests on specific apparatus and station components to determine if they were acceptable for installation.

3. Field tests to verify the system performance under actual or simulated operation.

As an example of the first type of tests, the wet and dry impulse, switching-surge, and 60-cps performance of insulators and air gaps was determined for voltages from 345 to 750 kv. Experiments were made on vertical insulator strings, V-strings, pedestal insulators, horizontal and vertical gaps, and insulator guy strings. Laboratory insulation data on large configurations was

rare in the literature, and practically no data was available on the wet switching-surge strengths of outdoor insulation structures.

Important conclusions from these laboratory investigations are:

a. Impulse strength (dry or wet) increases almost linearly with insulation length up to 3,000 kv.

b. The 60-cps and switching-surge strength show significant departures from linearity, particularly under wet conditions. In some cases the wet switching-surge strength is equal or lower than the wet 60-cps strength. Insulation strengths of 8 to 11 kv per in. were frequently observed for larger gaps.

c. Unusually low dry positive-polarity switching-surge strength, as low as 4.6 kv per in., occurred on large gaps comprising a very nonuniform positive electrode and a large ground plane. This effect, created by the ground plane, can be avoided by maintaining both electrodes reasonably nonuniform.

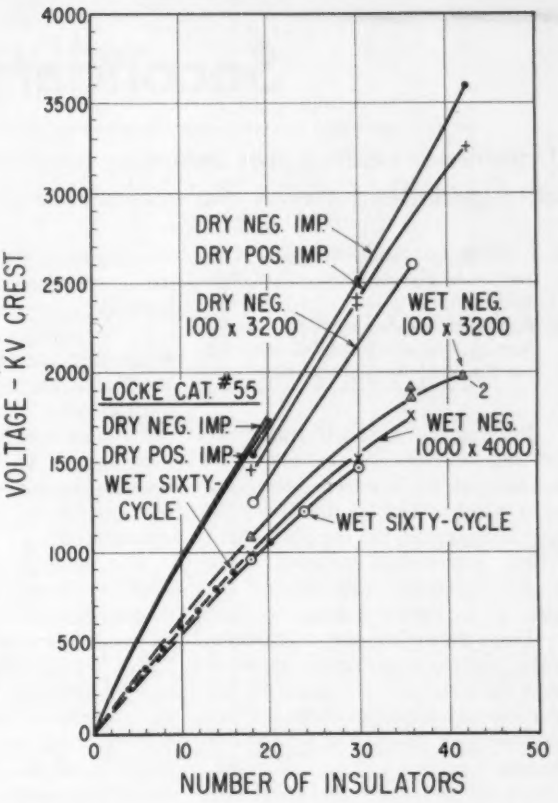
Although standard impulse wave shapes have been established for many years, no standard wave shapes are available for switching surges. After a study of wave shapes obtained in the field and on miniature model systems, switching surges having times to crest of 100 and 1,000 microseconds were adopted. The tail lengths of these waves were 3,200 and 4,000 μs respectively, but it was found that this had little effect on the flashover characteristics since all flashovers occurred at or near the crest of the wave.

As an example of the second type of tests, the 650-kv, 2,050-kv BIL disconnect switch was thoroughly tested for radio noise and insulation characteristics in the laboratory. Tests were made with the Stoddard radio-noise meter according to NEMA specifications. The switch has an RIV below the specified 500-μv level for voltages up to 500 kv to ground, equivalent to 860 kv between phases.

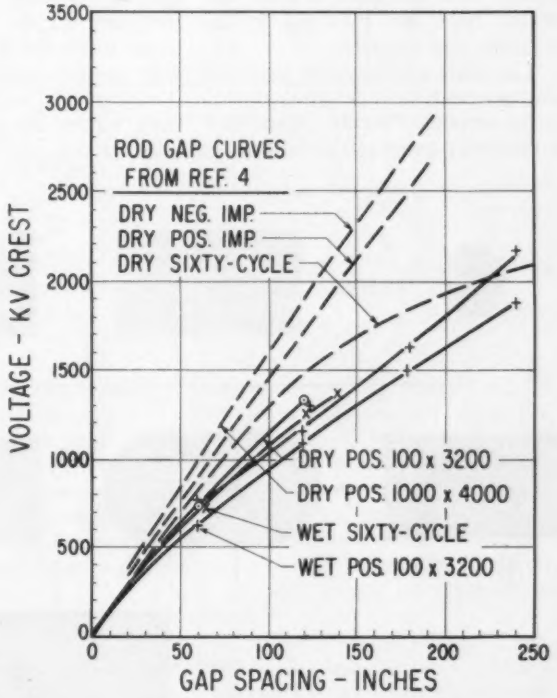
As an example of the third type of tests, the entire North Station was raised to 720 kv during the night and sources of visual corona were carefully observed. Although no corona had been noted on the 650-kv disconnect switch during the laboratory tests, two phases produced plumes several in. long from the vertical blade ends when operating above 650 kv. The reason for the different behavior is attributed to the proximity of the aluminum tower truss above the disconnect switch, obviously not reproducible in the laboratory. The corona was eliminated by modifying the ends of the switch blades.

A recent measurement of conducted RIV in the North Substation was made at 390 and 700 kv, from 200 to 3,500 kc. The RIV at 700 kv paralleled that at 390 kv and was only 10 db higher. At 1 megacycle and 700 kc the measured value of RIV is 338 v, comparing very favorably with the specified value of 1,000 μv at 712 kv.

Extensive field tests will be made of the insulation of the North and South Substations using the impulse generator rated 3,000 kv and 250 kw-sec, one of the world's largest, about 1,500 ft from the North Station and 4 miles from the South Station. Consequently impulse waves will have attenuation and distortion due to corona when traveling towards the South Station but will reach the North Station almost unmodified. Voltages and arrester currents will be measured at various locations by cathode-ray oscillographs.



DRY SWITCHING FLASHOVER curve is 15% below dry impulse curve for twin suspension strings of ten insulators



WET SWITCHING-SURGE FLASHOVER CURVE is actually lower than 60-cps flashover curve for horizontal gaps

Secondary Network Problems

Transformer loadings and secondary-line flows determined; data guide load-growth and system enlargement planning

R. F. COOK, Distribution Engineer, Westinghouse Electric Corp, East Pittsburgh, Pa.

C. A. JACOBSON, Engineer, Distribution Section, Western Massachusetts Electric Co, West Springfield, Mass.

Ratings for installed transformers and locations for new ones were established by Western Massachusetts Electric Co on the IBM 704 digital computer for the Springfield, Mass., low-voltage network. The study determined the number and size of secondary conductors also.

These data were part of the complete loading and voltage information obtained for the network under normal loading conditions and single-circuit contingencies. Transformer loadings and secondary-line flows for the entire network area are now recorded for these circumstances, the data making practicable detailed studies of network segments where load growth is imminent and affording a more accurate basis for planning system additions and changes.

The study was based on the 1959 summer peak loads and impedances of the secondary mains. Made with a computer program developed by Westinghouse Electric Corp, it built up a mathematical model of the network, preserved on magnetic tape, for studies of future changes. Formerly, the utility made such studies on the dc board, a method impracticable for such detailed analysis on a network section of this magnitude. The digital computer, besides being economical, controls the accuracy of the network representation.

The network is supplied by 16 13.8-kv feeders to 108 network transformer installations, each with its secondary-network protector. There are 42 500-kva, 38 300-kva and 25 150-kva 3-phase units, plus three banks of three 100-kva, and one bank of three 167-kva single-phase transformers. The 120/208-v secondary mains are rubber-and-Neoprene cables, mostly No. 4/0, but on specific runs some 500 MCM. Neutral conductor is No. 4/0 bare tinned copper.

The secondary network load-flow program for the 704 digital computer solves for system bus voltages, line power flows, and transformer loadings. It accommodates a system having a maximum of 250 buses and a combined total of 500 lines and transformers. But these limitations do not restrict the size of system that can be studied, as a very large network can be broken up into several smaller overlapping sections, each of which can be studied separately.

The method of obtaining the load-flow solution is similar to that described by J. B. Ward and H. W. Hale in "Digital Computer Solution of Power-Flow Problems," AIEE Transactions, Vol. 75, Pt. III, 1956, pp 398-402. The general workings of the program are illustrated in Fig 1. The program has three basic parts: The input, which includes reading into the computer all appropriate information on secondary mains, transformers, buses, loads and other system parameters. This part also includes the processing of the input data so that the matrices, tables, etc., are formed with the correct values in the proper units.

Correction Calculated

The second portion of the program is the iterative calculations. As this process is repeated often, special care must be taken to keep the various operations to a minimum. Using 1.0 + j0 per unit voltage as an initial estimate for a particular bus voltage, the sum of the load flows around the bus is calculated. From this sum a correction is calculated and applied to the bus voltage. Each bus is treated thus in turn, this being one iteration. The process is repeated as often as necessary to reduce the maximum error in the real and reactive portion of any calculated load at a bus to or below the value specified as accurate in the input data.

The program's third portion is the output. When iterative processes have converged to the specified accuracy for the loads, the basic information available in the computer is the real and imaginary parts of the voltage at each network bus. These values of voltage are used to calculate power flows in the network. Then an output tape is written to include these power flows and other information.

Although the secondary network

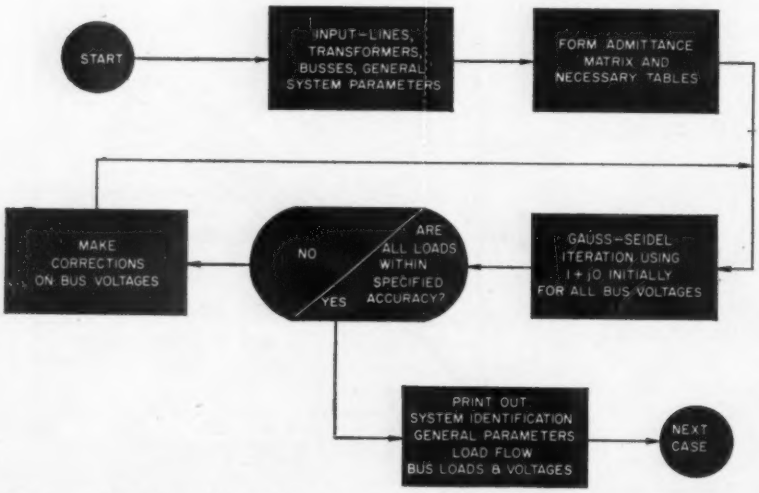

START
INPUT—LINES, TRANSFORMERS, BUSSES, GENERAL SYSTEM PARAMETERS
FORM ADMITTANCE MATRIX AND NECESSARY TABLES
GAUSS—SEIDEL ITERATION USING 1 + j0 INITIALLY FOR ALL BUS VOLTAGES
ARE ALL LOADS WITHIN SPECIFIED ACCURACY?
NO
YES
MAKE CORRECTIONS ON BUS VOLTAGES
PRINT OUT SYSTEM IDENTIFICATION GENERAL PARAMETERS LOAD FLOW BUS LOADS & VOLTAGES
NEXT CASE

FIG 1—GENERAL WORKINGS of computer program are illustrated in this simplified logic flow diagram. The program consists of three basic components

Yield to Digital Computer

load-flow solution is obtained by the same basic method described by Ward and Hale for obtaining transmission load flow, the input and output data are different in form because of the smallness of secondary network quantities. The planning engineer, handling the latter, evaluates his results quicker when additional quantities are available. The secondary network program, accordingly, has been tailored to meet these needs in the following fashion:

Input Data:

A. Line and transformer impedances are accepted in actual ohms resistance and reactance times 10,000.

B. System loads are entered in kw and kvar.

C. Shunt capacitors can be considered at any bus by listing the capacitor kvar on the appropriate input data sheet.

D. The accuracy of the solution can be controlled by specifying in the input data the maximum allowable error in the value of load kw and kvar. This means that the values of load kw and kvar that the computer will actually use will differ from the values listed in the input data by no more than the specified accuracy values.

Output Data:

A. Power flows at each end of a line or transformer are listed in kw and kvar.

B. Kva and current in amperes are listed for each line and transformer.

C. Each line or transformer is identified by a number and a six-character name.

D. Each bus is identified by a number and a 12-character name.

E. The error for the load at each bus is listed in kw and kvar.

F. The voltage at each bus is listed in percent of the base voltage.

Once a base case has been completed, additional cases can be solved by reading in only the changes from the base case for each of the new ones. Consequently, the user of the program must fill out a complete set of data sheets for the base case and for each successive case only items that are different from those of the base case. Once the base case has been run on the computer, its data is preserved on tape so that additional cases can be restarted at some later time without re-reading the entire system data.

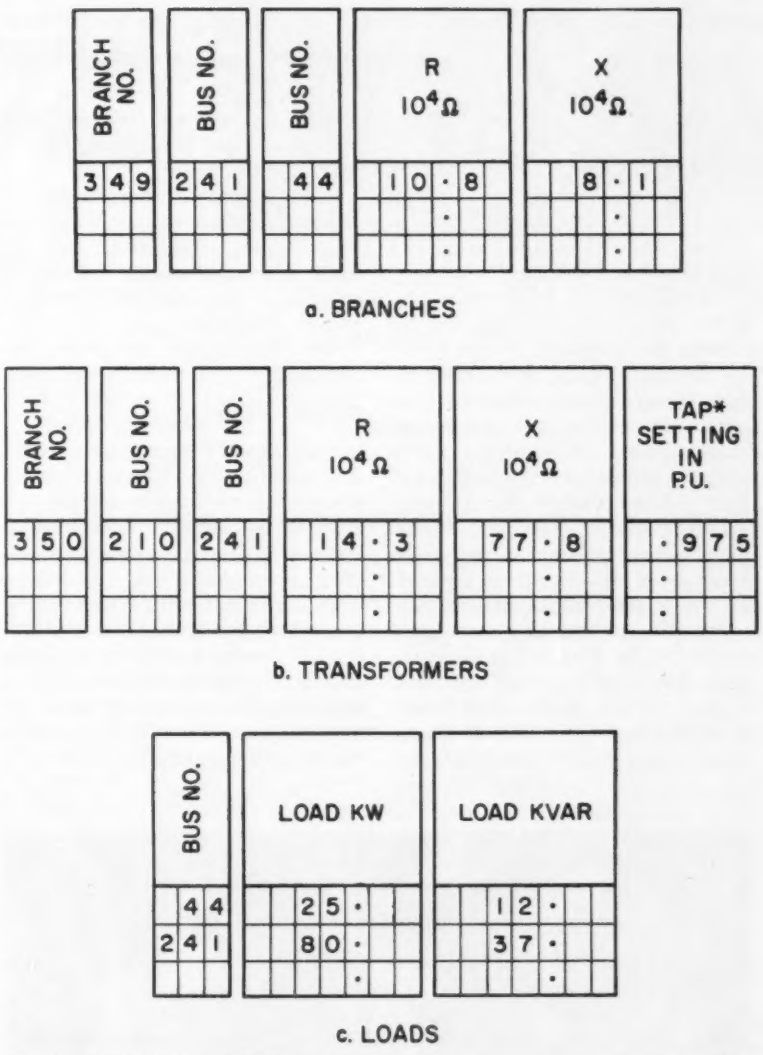


FIG 2—INPUT DATA SHEETS are those used for secondary network analysis. Inpedance data in terms of resistance and reactance are recorded

As the Springfield network was too large to run through the computer in one pass, it was split into two systems, north and south, each section overlapping the other by at least one city block.

Computer times required for the base case solutions for each part of the network were for the 250 bus north system 4.5 min; for the 237 bus south system 5.8 min. More time for the slightly smaller portion of the system reflects the effects of different system configurations and ranges of impedance values.

The following step-by-step procedure obtained the input information for use with the digital computer program:

(*Continued on page* 64)

MVEA Told Sales Techniques

Kansas City conference hears that heating, cooling, and lighting for commercial buildings should be coordinated

"Electric building conditioning" was offered by W. G. Dorsey, Worthington Corp, to the industry as a concept embracing a coordinated system of electric heating, cooling and lighting in commercial and industrial buildings.

Local, regional or national programs based on this new concept should be promoted cooperatively by electric utilities, mechanical refrigeration manufacturers and others to counter the inroads of absorption-gas refrigeration, Dorsey told the Industrial and Commercial Sales Conference of Missouri Valley Electric Assn at Kansas City, Mo. He listed points to be made over gas-absorption systems in selling mechanical refrigeration.

At the meeting the first gold medal in the Power Up Achievement Award program was presented to B. J. George, Kansas City Power & Light Co. C. W. Mills, Westinghouse Electric Corp, said the first-place sales job was selected from over 80 entries from more than 30 utility companies.

The program stresses industrial sales jobs reflecting creative selling, perseverance, imaginative use of trade allies, and enlightened understanding of the customer's problem. Mills announced that the 1961 Power Up program will provide for awards for commercial power sales.

Exhaust Cools

Utilization of the required waste-air exhaust as a cooling medium allows the use of the higher IES lighting standards without a great increase in air-conditioning requirements in high-rise office buildings. This coordination of systems, explained J. E. Flynn, General Electric Co, can be applied by using the heat from high lighting levels as a supplementary source of heat for the building. He said that such a use provided two-thirds of the heat for a New York office building and 80% in a Midwest supermarket.

Flynn said that work is being done by non-electrical manufacturers to combine heating and cooling in lighting fixtures using integral water cooling tubes. He also described an integrated heating-cooling lighting system completed by Rochester Gas & Electric Co and an integrated heat pump-lighting system in a Canton, Ohio, furniture store.

Reports prepared by electric utilities for industrial customers help to put the customer in a mood receptive to the utility's recommendations, said Harold S. Nay, Kansas Gas & Electric Co. He stressed that such reports be neat and appealing to the customer at first glance. Report data must be factual and concise, and should include a request for the order or a recommendation that the customer take the course proposed.

Nay reported that the inclusion of a list of collateral advantages, with blanks for values to be filled in by the customer, establishes the value of these benefits. Basic, capital, and operating advantages of electricity over a competitive commodity make up this "plus-value" check list.

In selling customers on the new higher IES lighting levels, more attention must be given to the quality of light provided in commercial applications, said Dean Barnhizer, Iowa Electric Light & Power Co.

Floodlighting for a used-car lot and for the fronts of a department store and office buildings were described by E. J. Cook, St. Joseph Light & Power Co. These applications on an off-peak lighting rate dramatically show what floodlighting can do for the electric company and the customer, said Cook.

Demonstrating what electric cooking on a microwave range can do for the food service customer is one way to build this type of load, said R. F. Rice, Kansas City Power & Light Co. Using a "steak-house" restaurant as an example, Rice outlined a technique whereby a series of questions leads the customer to point out the bottlenecks and costly operations in his establishment.

GOLD MEDAL WINNER in Power Up program is B. J. George, KCP&L, who receives his award from C. W. Mills, Westinghouse, at MVEA conference

Cooperation Urged On APPA

Joint planning among municipal, rural, and federal operations held means of getting full value of dollar

J. H. HINMAN, Ft. Wayne, Ind., addresses APPA. Shown with him are W. C. Henderson, mayor of Colorado Springs, Colo.; D. J. DeBoer, APPA president; and Ray Nixon, director, Dept of Public Utilities, Colorado Springs

"Full value for your dollar" was the theme of the American Public Power Association Engineering & Operations Workshop recently in Colorado Springs, Colo. The main benefit to participants, who came from all over the country, lay in sharing experiences.

In the keynote address, APPA Pres D. J. DeBoer pointed out the need for cooperative planning.

"We are in an era of mass production, mass transportation and mass consumption. To survive as electric utilities, we must gear production, transmission and distribution of electric energy to this mass concept," he said.

"It will become more and more difficult for our smaller, isolated systems to maintain a competitive position unless we face up to this situation. This problem can only be solved by coordinated and cooperative effort among neighboring utilities—municipal, rural and federal. By pooling reserves, utilizing natural load diversity, sharing in the use of larger, more efficient generation and exchanging economy energy, the locally owned public utility can be in an excellent position to maintain and improve its independent position without losing identity or surrendering local control.

"Sound planning for the future," said DeBoer, "indicates the need for: improvement in load factor through aggressive load building programs; use of inexpensive automatically controlled peaking capacities, such as gas turbines and package diesels; and interconnections with neighboring utilities to take advantage of natural load diversity among localities and areas."

DeBoer pointed out that seven municipal systems in Kansas recently authorized engineering studies looking towards interconnection and pooled operation. He said that many municipal systems are interconnecting or planning to interconnect with the large federal projects in the Missouri River and Upper Colorado Basins.

A particular problem pointed out by DeBoer concerns the question: Who shall serve electric consumers in newly annexed areas as city limits expand?

"We are especially concerned about this problem where a municipally owned electric system and a rural electric cooperative are involved since both are consumer-owned, non-profit utilities and so have many interests in common," he said. "If these service-area problems are permitted to develop into bitter and divisive conflicts, the chances for fruitful cooperation on other problems will be much less, and consumers served by both systems are apt to suffer.

"Both the APPA and the NRECA are interested in encouraging the members of our two associations to develop jointly agreed-upon local policies which anticipate these service-area problems, and to try to work out such problems as do arise on a friendly and constructive basis. I understand that the joint committee has a statement published recently, agreed to unanimously and recommended to the two boards of directors. Any such policy statement must necessarily be very general, however. The real job of working out these problems will have to be done at the local level."

In describing the Missouri River Basin Project Power Plan, which consists of two power systems, Harold R. Lee, US Bureau of Reclamation, proposed that strong transmission ties be erected between the eastern and western divisions. He suggested that a 345-kv line be built from a large plant on the Missouri River to northeast Colorado, from which an interconnection with the Upper Colorado River system would be made through several 220-kv lines. Further, said Lee, we must strengthen our western division with 220-kv lines from Yellowtail (in Wyoming) to Colorado and possibly into Oklahoma and Texas areas.

Interconnections to Be Studied

Lee said these and other lines, that will be determined by technical studies, will be a part of an inter-area high-voltage transmission system that will tie together all regions of the country and take maximum advantage of time zones, climate differences, and loads diversity between various areas. Further, these lines must be interconnected to large steam plants. The coal fields of the Dakotas can provide fuel for some. The coordinated operation of these steam-operated with existing hydro plants will truly utilize the combined system to its fullest potentials and be developing our natural resources with sound business principles.

Lee said the eastern division power system of the Missouri River Basin Project had an installed capacity of 955 Mw as of January

1, 1961, with an estimated December capability of 770 Mw. In the immediate future, the second power plant at Ft. Peck will have two additional 40-Mw units by March and June of 1961, making a total installed capacity of 165 Mw. Seven 85-Mw units have been ordered for Oahe Power Plant near Pierre, S. D., which is scheduled to have its first unit on the line in July, 1962, with the others following at four-month intervals to make a total installed capacity of 592 Mw. Big Bend Power Plant is in the program on the main stem, with seven additional 58-Mw units being installed for a total of 468 Mw in service by April, 1966.

Eastern Div Plans 2,098 Mw

The total planned installed capacity for the eastern division, said Lee, will be 2,098 Mw on completion of the Big Bend Power Plant. After all the reservoirs are full and in normal operation, the estimated dependable capacity for December will be 2,016 Mw with an annual energy generation of 9½ billion kwhr, probably by 1965. To market electric power in the eastern division, the Bureau has completed 4,150 miles of 230-kv and lower-voltage lines prior to 1961 and 1,360 miles of additional 230-kv lines are scheduled for completion between now and October, 1962. Under the present plan, the Bureau expects to deliver 100% of preference customers' 1963 loads in the eastern division throughout the basin marketing area, Lee said.

The eastern division is now tied in with and operating satisfactorily with a vast transmission grid reaching into the eastern US. Progress is being made toward an operating interconnection with the Northwest Power Pool, but this has not been practical so far due to a weak tie at Ft. Peck and the different types of load and frequency control on the two systems. Necessary changes and additions at Ft. Peck are expected by June, 1962. New control equipment for regulating plants, including Grand Coulee, Bonneville, and others of the Northwest Power Pool, will be installed by mid-1963. When these modifications are completed and an interconnection is made at Ft. Peck, we will be well on our way to a nation-wide interconnected system, said Lee.

The western division of the Missouri Basin is now interconnected and operating with the Northwest Power Pool. This interconnection is made possible through Montana Power Co's 161-kv line from Billings to the USBR proposed Yellowtail site in northern Montana. However, we do have frequency problems, said Lee. The Northwest Power Pool has not in the past operated with as close a control frequency as the western division power system. With changes being made, this difficulty will be overcome. In the meantime, said Lee, we operate with standing orders to our dispatcher that if the frequency variation between the two systems varies 0.2 of a cycle either way, or the time varies 15 sec either way, the interconnection will be opened until corrections are made on the Northwest system.

Western Div Program Near End

Lee said there are 16 hydroelectric plants in the western division which vary in nameplate capacity from 1.6 to 71.5 Mw, for a total of 392 Mw. December capability in an adverse year is estimated at a little over 300 Mw. With the completion of the second 24-Mw unit at Fremont Canyon, the planned power program for the western division is at an end. However, one more plant between the eastern and western power divisions has just gone into construction—that is the Yellowtail, scheduled for completion in 1965. That plant will have four units with a total installed capacity of 200 Mw, although the capability for delivering firm power will be approximately 130 Mw. The Frying Pan-Arkansas Project is now under consideration for authorization by Congress.

Studies indicate that preference customers' loads could be supplied from the western division power system only through 1963. However, these criteria were established before authorization of the Upper Colorado River Storage Project, and I am sure the Bureau will have to review its position, said Lee. Power from Flaming Gorge should be available in 1963 and power from Glen Canyon in 1964 or 1965. About this time, Yellowtail will be ready to deliver power to the area.

For the future, in the western division, said Lee, plans are now being studied for transmission lines from the Upper Colorado River Storage Project, marketing rates and criteria are being determined. He also suggested that a 1950 USBR reconnaissance study of additional hydroelectric potential in the Missouri Basin be reviewed. This study indicated there were about 150 sites that could be considered good or fair prospects. These have a total capacity in excess of 2 million kw, or the equivalent of all the Corps of Engineers' plants on the Missouri River.

Peaking, Losses Studied

In keeping with the convention theme "Full Value For Your Dollar," there were two presentations of particular interest. Gordon D. Jorgenson of R. W. Beck & Associates discussed "The Economics of Satisfying the Annual Peak Demands Imposed on an Electric System" and John W. Boehr, Los Angeles Dept. of Water & Power, spoke on "Power System Losses—Economics & Evaluation."

There is no magic formula that can be universally applied to the solution of a system-peaking problem, stated Jorgenson. Using three hypothetical power systems with different generation and load characteristics, Jorgenson showed that each situation is a special problem and must be so treated if meaningful results are to be obtained.

"We have found that a prerequisite to a competent study is a careful analysis of the utility system's over-all power supply problem, with consideration given to basic-power marketing rates and load-building policies," Jorgenson said.

"This must be followed by a thorough analysis of the several methods of supplying peaking power with due attention given to an analysis of the over-all power supply problem during the course of the study. A great deal of engineering judgment must be exercised in the final selection of generation or arrangements for purchased power."

Recommending a continuous attack on power system losses, John Boehr said the place to begin is in the few hundred feet of the system nearest the customer's meter, then the distribution transformers and primary circuits. Later, attention should be focused on the subtrans-

(*Continued on page* 106)

WWP DIVISION LINEMAN, Lloyd Fisher, demonstrates the pole-wrapping technique to prevent fire damage

Foil Foils Pole Scorch

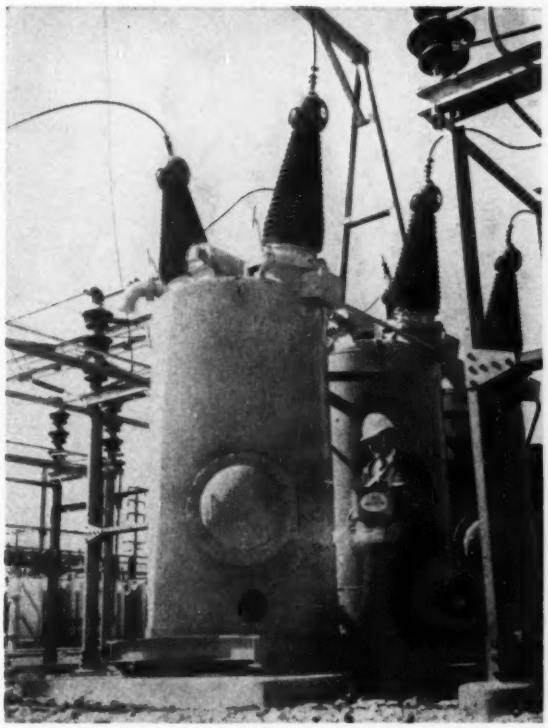
A way literally to foil brush fire damage to utility poles has been figured out by Frank Frost, Washington Water Power Co district manager at Orofine, Idaho. When a brush fire broke out on the outskirts of Orofine in September, Frost hesitated only for a moment and then rushed out to the nearest supermarket to buy a bundle of household aluminum foil. With the help of several office employees, the foil was wrapped and stapled on the lower 6 ft of eight poles. The flames went right past the poles but none were scorched or damaged. WWP officials said they normally expect some pole damage in brush fires of this type.

Pelletized Herbicide Easier to Apply

A pellet-type weed killer is easier to handle, less likely to blow or wash away, and is a more concentrated herbicide. This is the experience of Oklahoma Gas & Electric Co with Ureabor, a pelletized weed killer made by US Borax & Chemical Corp.

Prior to 1956, the company used a powder-type weed killer to keep substation sites clear of weeds. But it was found that Oklahoma winds would often blow part of the chemical away, both during and following application. In 1956, the company purchased Ureabor, a product in the form of pellets about the size of gunshot. Experience proved that the pellet-type chemical was easier to handle and distribute evenly and that it stays where it falls on the ground, despite wind and rain.

Because the pellets are a more concentrated weed-killing chemical, storage space is saved. An equal amount of pelletized chemical can be stored in 25% of the space necessary for storing powder. Shipping and handling costs are also reduced. Besides being easier to spread, the pellets do not get into the clothing and on the bodies of the men applying the chemical as the powder often did. A small, convenient, hand-carried spreader is used to broadcast the pellets.



OG&E OPERATOR BROADCASTS pellitized herbicide by means of convenient hand-operated mechanical spreader

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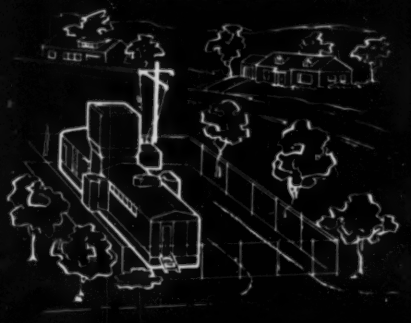
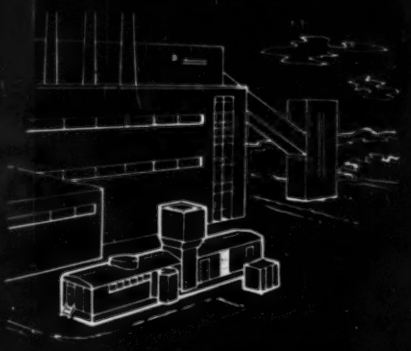
$85/kw multi-purpose power generation with proven gas turbine

Emergency, standby and end-of-the-line power from quick-starting, remote-controlled gas turbine package power plant.



Quiet, on-the-spot peaking power for suburban areas from effectively silenced gas turbine package power plant.



Emergency auxiliary power for steam station from package plant powered by experience-proven gas turbine.

Complete, self-contained, compact power plant — and it's available for operation on your system this year. The plant supplies dependable turbine power, 11,250 kilowatts*, for a variety of short-duration loads.

Package design offers significant manpower and maintenance economies, maximum site selection flexibility, and $85/kw low initial cost. G-E gas turbine reliability is backed by over five million hours of rugged operation — peaking and base-load utility service, continuous duty in process plant drives, start-stop service in locomotives, and base-load power for pipe-line pumping.

For more information on this new concept in power generation, contact your G-E Generation Sales Engineer or write for Bulletin GED-4217, General Electric Co., Section 247-44, Schenectady 5, N. Y.

* Peaking capacity at 80F, 1000-ft. altitude.

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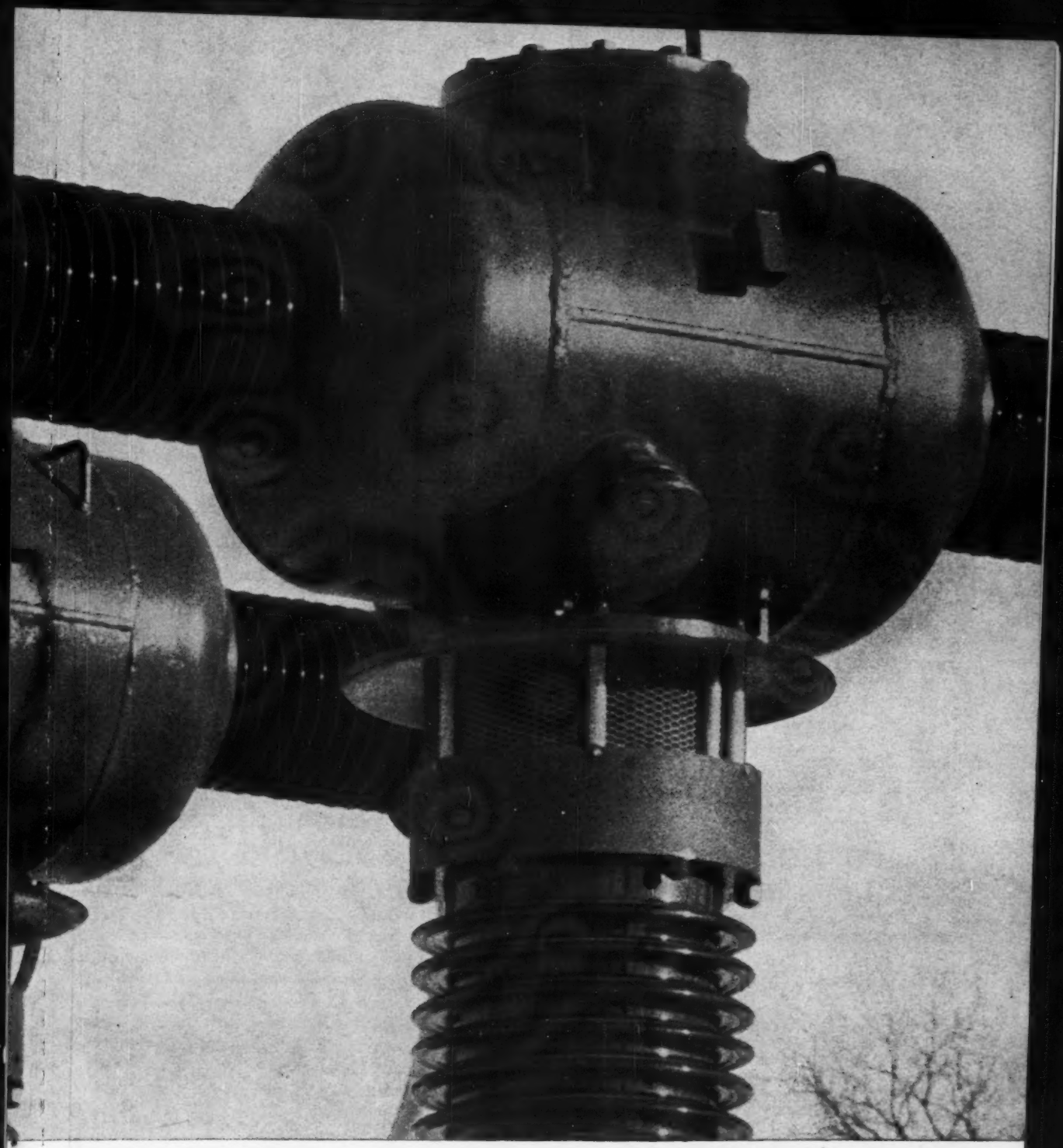
Interrupt power faults in 1/20th of a second or less

It happens in a lamp bulb flicker your customers won't even notice.

At installations like the United Illuminating Company's new Sackett Point Substation (above), General Electric ATB Air Blast Breakers provide lightning-fast interruption to clear a fault in three cycles or less—1/20th of a second.

Faster yet, pioneering Air Blast installations of the American Electric Power System, now on order, will clear the backbone of its 345 kv trans-



mission network in two cycles—snuffing out the equivalent of 33½ million horsepower in 1/30th of a second.

Speed means better stability for your system when it is challenged by one of today's high capacity power faults.

Speed means breaker contacts erode less, providing tangible maintenance and dollar savings.

Speed means you can transmit more power per circuit.

Let's go into detail: In General Electric Air Blast Breakers, air is stored under pressure right at the contacts. As a fault is sensed, contacts and a blast valve whip open simultaneously. The contacts stretch the arc, and a torrent of high-pressure air blasts through it. The arc is instantly forced to arcing probes and orifices, and extinguished. Contacts reclose, and the circuit is ready to go back into service—fast.

For more information about why G-E Air Blast Breakers should stand as the first line of defense for your transmission system, talk to your General Electric sales engineer, or write for GEA-6908. *General Electric Company, Schenectady, N. Y.* 493-11

Progress Is Our Most Important Product

GENERAL ELECTRIC

Secondary Network Problems Yield to Digital Computer (*Continued from page 55*)

Step 1. Each of the two sections was numbered to indicate bus points and branches. Each bus point represented an existing manhole in the network area and each branch the secondary mains between two bus points.

Step 2. Branch impedances were calculated, for which calculation branch distances and sizes and the number of secondary conductors were needed. A system of network record maps showing distances between manholes and the number and size of secondary conductors was used in obtaining the impedances. All impedances were calculated in terms of resistance and reactance and recorded on forms shown in Fig 2a. Transformer impedances and tap settings were recorded on forms shown in Fig 2b.

Step 3. Network loads were determined in kw and kvar. This was done by obtaining all customer loads at the time of the summer peak. Most customers had kw demand meters, so that this portion of the customer loads was available for study. The remaining loads were converted from kwhr readings as follows:

Three general types of customers are served: residential, commercial, industrial. For areas having only residential customers, a conversion factor of 500 kwhr = 1 kw demand was used. For areas having only commercial or industrial customers, a conversion factor of 200 kwhr = 1 kw demand was used. For areas where all three types of customers are combined, the conversion factor was dependent on the proportion among usages. All loads within the network area were thus converted to kw demand.

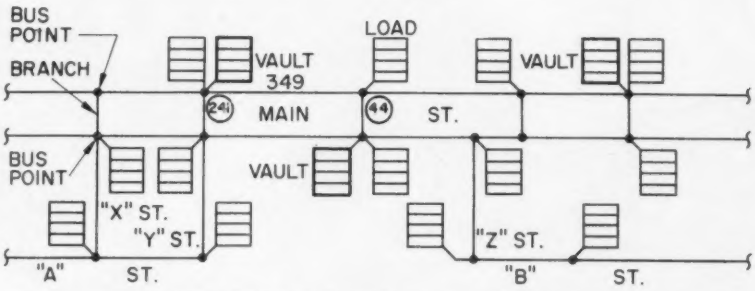


FIG 3—SECONDARY NETWORK SYSTEM of Springfield is shown in part, this system of network plates being used to record and compare input and output

Power Factors Found

From current, voltage, and kw readings available, power factors were determined for each area. Kvar demands were obtained for each bus point. This information was then placed on input data sheets like those shown in Fig 2c.

Sample sheets of output data would contain: Branch load flow in kva and amperes, direction of flow, line losses in kw and kvar, transformer loadings in kw, kvar, and kva, and bus voltages, loads, and load accuracies. The system of network plates in Fig 3 records and compares all input and output information on loads and spot readings on network transformers for the base case. The transformer loadings obtained from the computer were checked against transformer spot readings taken over a week during the 1959 summer peak season.

Upon completion of the base case, contingencies were studied for each of the two sections. A contingency consisted of removal of one primary line and associated transformers and opening the associated network protectors. Transformer and load flows were once again obtained and their results evaluated. All output information for the base case, as well as the contingencies followed the same form.

Low Voltage Network Computer Study—Springfield—1959 Summer Loads—South Section—Base Case 1

Branch	Bus A	Bus B	Flow From Bus A Kw	Flow From Bus A Kvar	Flow Into Bus B Kw	Flow Into Bus B Kvar	At Bus B Kva	At Bus B Amp	Line Losses Kw	Line Losses Kvar
349 BR 349	241	44	178.16	69.72	177.30	69.08	190.28	514	.86	.64
350 BR 350	210	241	248.96	148.83	246.50	135.47	281.28	756	2.45	13.36

Fixed Tap Setting .975

Bus	Load Kw	Load Kvar	E Pct	Ang	Accuracy Resp	Accuracy Resq
44 BUS 44	25.09	12.28	98.923	−2.164	.0911	.2835
241 BUS 241	79.51	36.38	99.462	−2.079	−.4860	−.6231

Corrosion-resistance of Acco *Aluminized* Wire provides significant economies

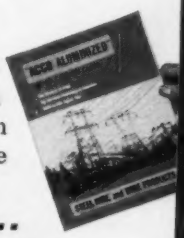
You can minimize losses due to corrosion, through the use of ACCO *Aluminized* strand for guys, messengers, and overhead ground wires, and in ACSR core wire. At PAGE, commercially pure aluminum is bonded to the steel wire by a patented hot-dip method that insures a tight bond of aluminum to steel. You get the strength of the highest quality steel wire combined with the corrosion resistance of commercially pure aluminum.

Millions of feet of aluminized strand and ACSR conductor with aluminized core in service in all parts of the country attest to the superiority of PAGE ACCO *Aluminized* Wire.

Strand • PAGE *Aluminized* Strand meets the physical properties of ASTM Spec. A-122-58 and A-363-58. Available in all sizes and grades.

Core Wire • for ACSR conductor. ACCO *Aluminized* Core Wire meets the requirements of ASTM Spec. 341-59T. In addition to vastly superior corrosion resistance, the danger of electrolytic action is eliminated when you use aluminized core wire.

When you specify PAGE *Aluminized*, you get not only the superior corrosion resistance of aluminum but also the highest quality steel wire—produced by a manufacturer with fifty years experience in the development and manufacture of wire for utility service.



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2170 SUBSTATIONS AND 40 YEARS LATER...

SOUTHERN STATES IS STILL LOOKING FOR THE MAGIC FORMULA

A great deal has been said about *standardized substations*. As much as we like the basic idea, the one thing we have learned is that there is no cut-and-dried, assembly-line, easy way to produce substations on an industry-wide basis.

We've been at it 40 years, producing more than 2170 substations of all kinds, and it has always been tough for us!

Even stations with essentially the same assignments have endless arrangements. Infinite combinations of design preclude standardization in the true sense of the word. The exception is where individual utilities have developed their own standardized substation programs. Otherwise substations must be virtually custom-made.

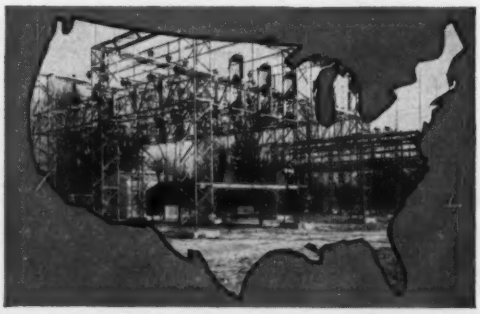
True, hundreds of designs in our files are helpful. Many standard components are picked up and used, with ultimate savings to our customers. And the years of practical experience of our design staff guides us, and our customers, around many pitfalls.

But you can't escape the fact that supplying substations requires these basic functions: skillful engineering, careful detailing, precise coordination of production schedules, and delivery on time. At least, that's what we've learned 2170 substations and 40 years later. And that's how we approach every substation assignment.

On this basis, you might like to do business with us. We'll welcome your inquiry. Just call your Southern States representative or write to us direct.

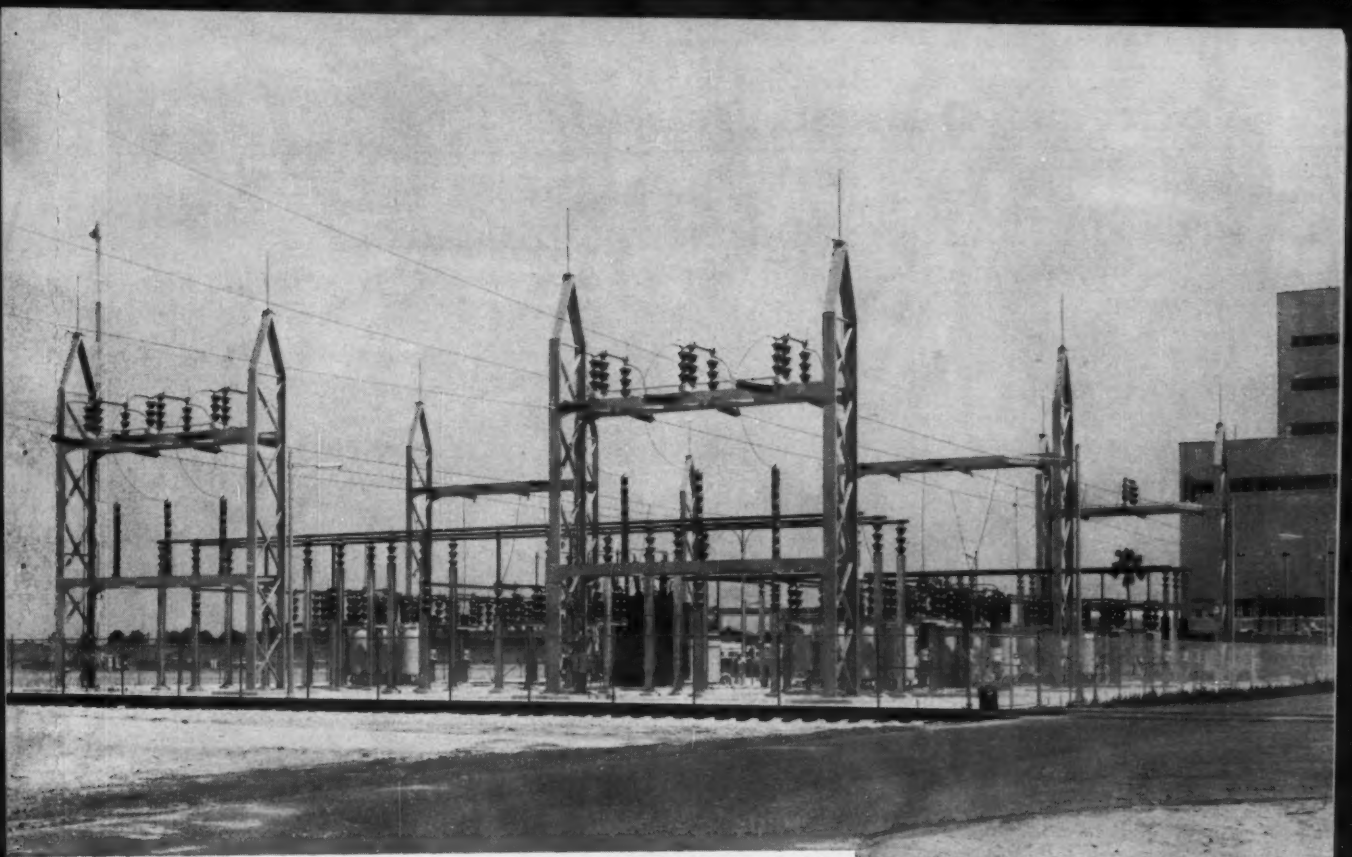
SOUTHERN STATES SUBSTATIONS ARE IN USE ALL OVER THE NATION

During the past 40 years Southern States has produced 2170 outdoor substations for hundreds of different customers. They range from small 5000 kva units to switchyards exceeding 1-million kva, and include substations for the nation's newest atomic systems. Regardless of size, Southern States scrutinizes every detail —from single-line wiring diagram to the finished station.



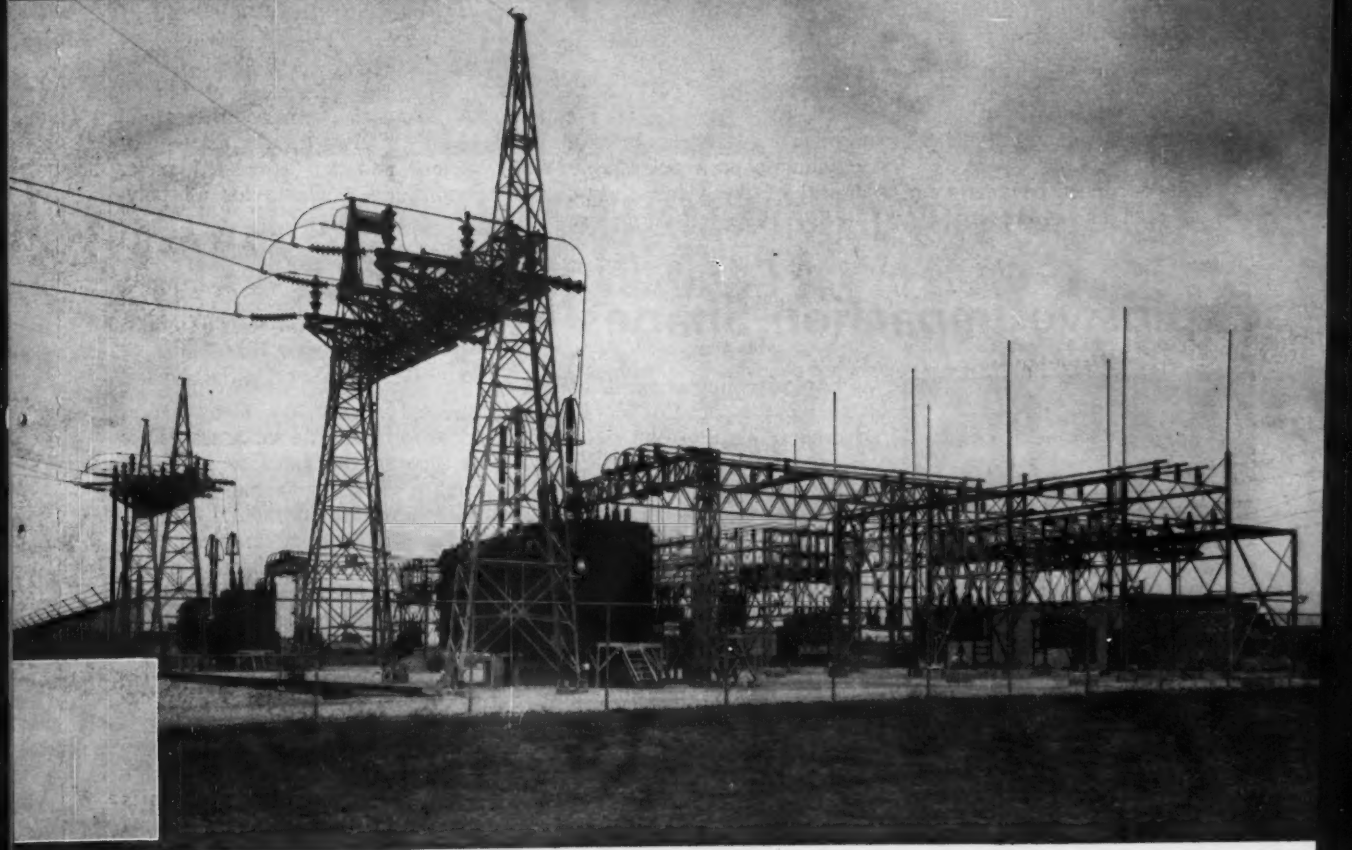
SOUTHERN STATES EQUIPMENT CORP.
HAMPTON, GEORGIA

IN CANADA: Dominion Cutout Co., Ltd., Toronto



Indian River Substation, Orlando Utilities Commission, Orlando, Florida

Warson Substation, Union Electric Company, St. Louis, Missouri



Provide Positive Short-Circuiting of CT's

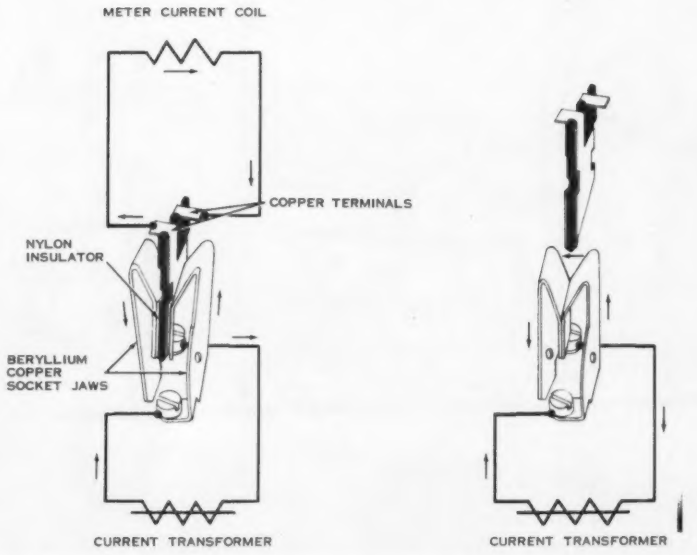
DALE F. BECKER, Project Engineer, Engineering Dept, Sangamo Electric Co, Springfield, Ill.

An improved metering equipment for current transformer installations features a meter base and associated socket assembly which together provide a reliable short-circuiting system. Called "Autopass," it meets the need for a positive action, inherently safe design.

This short-circuiting system will effectively guard against the danger to personnel from open-circuited CT secondaries. Another is an open-circuit condition on a heavily loaded CT, which can damage the transformer accuracy by magnetization or breakdown of insulation.

It prevents wrong registration, low or high, due to failure of a short-circuiting scheme to open when the meter is plugged in. If only part of the total load current passes through the meter, substantial revenue generally will be lost. On the other hand, shunting of the meter current circuit affects phase angle, which could mean high registration on leading power factor loads.

The two copper bayonet terminals of each circuit are separated by a nylon insulator. When the meter is inserted in the terminal block, each pair of meter current terminals is placed between two beryllium-copper socket jaws. Withdrawal of the meter short-circuits the CT. The transformer is never left open-circuited.



DUAL BAYONET TERMINALS of meter current coil spread dual socket jaws (left) to complete the CT circuit; withdrawal of terminals allows jaws to spring together (right) to positively short-circuit CT

Autopass equipment at present is limited to Sangamo meters and sockets. Two and three-stator meters and an associated meter mount are available for all polyphase circuits.

Explosive Impaction Shapes Metals

Explosive impaction is used by General Electric Co for low-cost shaping of hard-to-form metals such as titanium, stainless steel and tungsten. Known as "capacitor discharge electro-spark forming," the method induces explosions through a buildup of electrical energy without chemical explosives.

GE's engineering laboratory has thus far successfully shaped titanium, niobium, beryllium-copper and the more difficult grades of stainless steel. It is believed that the new process can also be used in forming tungsten and molybdenum.

The electrical blasts are made to occur under water, creating high-intensity shock waves that are directed against the metal pieces to be formed. The shock waves are so intense that intricate contours can be blown into the metals in millionths of a second.

Forming is done at room temperature and no pre-heating of the metals is needed to make them ductile. The pieces take on the shape and surface texture of the die into which they are exploded and require minimum finish machining after they are removed.

The laboratory has formed pieces up to 10 in. dia and 3/32-in. thick and forming much larger pieces is considered feasible.

National rewinds steel mill motor during vacation shutdown ...completes job with 1 day to spare

"Thanks for a job well done" reported the customer after National Electric Coil completed this major motor rewinding a day ahead of schedule.

The timetable was very tight, as the 3500 H. P. unit drives the main reversing mill. All work had to be accomplished during a planned mill shutdown, with time allowed after installation for acceptance tests.

National's preplanning took into account the following unusual operations:

- Top half of the field frame had to be unbolted and slid over to one side as there was no crane at the location adequate in capacity to lift the frame.
- The armature, while in its own bearings, was stripped, cleaned, and rewound with NECCOBOND coils – all coils and winding supplies having been manufactured in advance to expedite installation.
- A special gear and brake were fabricated to permit turning the armature during installation.
- The commutator was turned and undercut and the armature banded before final reassembly of the motor.

For a "well-done" job on your rotating electric machinery rebuilding or service needs, contact National Electric Coil. Our service is fast, thorough and dependable. Call National's Columbus plant, HUdson 8-1151, or check the nearest National field engineer.

DIVISION OF

National Electric Coil

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McGRAW EDISON

COR-TEN Steel Joins EHV Project

A steel transmission tower that needs no paint or other applied coatings to protect it from atmospheric corrosion—the first of its kind ever to be erected in a power transmission line—is the unique feature of United States Steel Corp's participation in Project EHV.

Designed and recently fabricated by US Steel's American Bridge Division, the ungalvanized, unpainted structure will be erected soon as tower No. 18 on General Electric Co's prototype extra-high-voltage power system near Pittsfield, Mass. US Steel's metallurgical and corrosion experts believe the "bare" steel structure will show the way toward huge maintenance savings in the electric utility field.

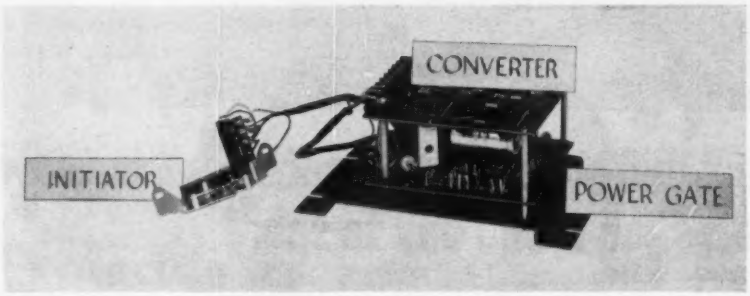
Challenging the need for costly anti-corrosion measures, particularly where atmospheric conditions and accessibility of tower sites present problems, tower No. 18 will be built entirely of uncoated USS—COR-TEN steel. All structural members as well as the bolts and nuts that fasten them together will be made from this economical, high-strength low-alloy steel which has 50% more yield strength and four to six times the atmospheric corrosion resistance of carbon structural steel.

US Steel officials emphasize that the uncoated steel structure will stay that way once it is put up; no paint or other protective coating material will be applied during its service life.

About a year ago US Steel revealed the results of some long-term atmospheric corrosion tests on the unpainted material. Periodic inspections and measurements on test specimens clearly show that the porous, flaky type of rust usually associated with plain carbon steel does not occur with COR-TEN. By contrast, a non-porous, tight-adhering oxide "skin" forms on a COR-TEN surface during the first 12 to 18 months it is exposed to the atmosphere. From that point on, little additional oxide formation occurs, and the initial skin remains tightly in place, preserving the steel's original strength and thickness.

Corrosion tests also show that COR-TEN's oxide coating has a different color than the rust which develops on plain carbon steels. It usually appears as a rich chocolate brown. In some industrial atmospheres it assumes a bluish tinge.

Meter Meeting Covers Mfrs' Developments



D-43 IMPULSE GENERATOR has no contacts to eliminate maintenance problems

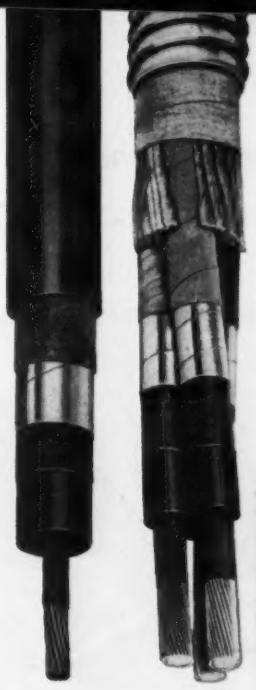
The spring meeting of the EEI/AEIC Meter and Service Committee, held last week in Cincinnati, Ohio, heard presentations by representatives of General Electric Co, Industrial Process Engineers, Inc, and Sangamo Electric Co on significant meter developments.

GE "RINGLESS" SOCKET . . . . . The 100-amp, or 200-amp, SI-60 features the same terminal block assembly with one-piece combination jaw and connector strap which was first introduced in the Type S-2 die-cast aluminum socket. The socket case is constructed of 16-gage zinc-coated steel with an oven-baked grey finish, or can be provided in sheet aluminum. It is spot-welded and available in three sizes. Six mounting holes, all incorporating knockouts, are provided for wall or pole mounting. Fixed hubs are of die-cast aluminum and are available in all popular sizes. The cover is provided with a simple one-piece latching lever and is designed to fit snugly around the cover ring of the watt-hour meter. While the 100-amp "ringless" meter sockets have been available for the past few months, the 200-amp units only recently have been made available.

GE states that the 200-amp SI-60 features a lower price than previously available sockets that meet the MSJ-7 200-amp heat-rise test requirements. This is made possible, it is said, by the design of the jaw and wire connector which is similar to that of the 100-amp models, and efficiently utilizes the electrical and thermal properties of the materials. The cases are physically larger in size but otherwise equivalent to the 100-amp models.

GE IMPULSE GENERATOR . . . . . The Type D-43 impulse generator is a completely solid-state system which consists of the D-41 initiator (unit in the meter), a converter, and a power gate. The converter and power gate are housed together in a suitable enclosure. The converter provides the power supply to the D-41 initiator, senses its photocell resistance changes due to shutter position and converts this

(*Continued on page* 74)



How Circle exceeds the specs to give you...

MAXIMUM DIELECTRIC STRENGTH

EVERY order for power cable calls for certain specifications to be met. At Circle, the point is not how well these specs are met – but rather how far *they are exceeded.*

Example: the well-known "double-voltage" test as required by IPCEA-NEMA. The table below demonstrates *one of the ways* Circle-sheath Type RR power cable exceeds specs to give users maximum performance. Circlesheath also excels in ozone resistance, long-term stability and other essential power cable requirements.

Power cable reliability is no haphazard achievement. It requires continuous supervision by men who not only care enough but know enough to produce the very best. Specify Circle on your next job – there's no finer cable made.

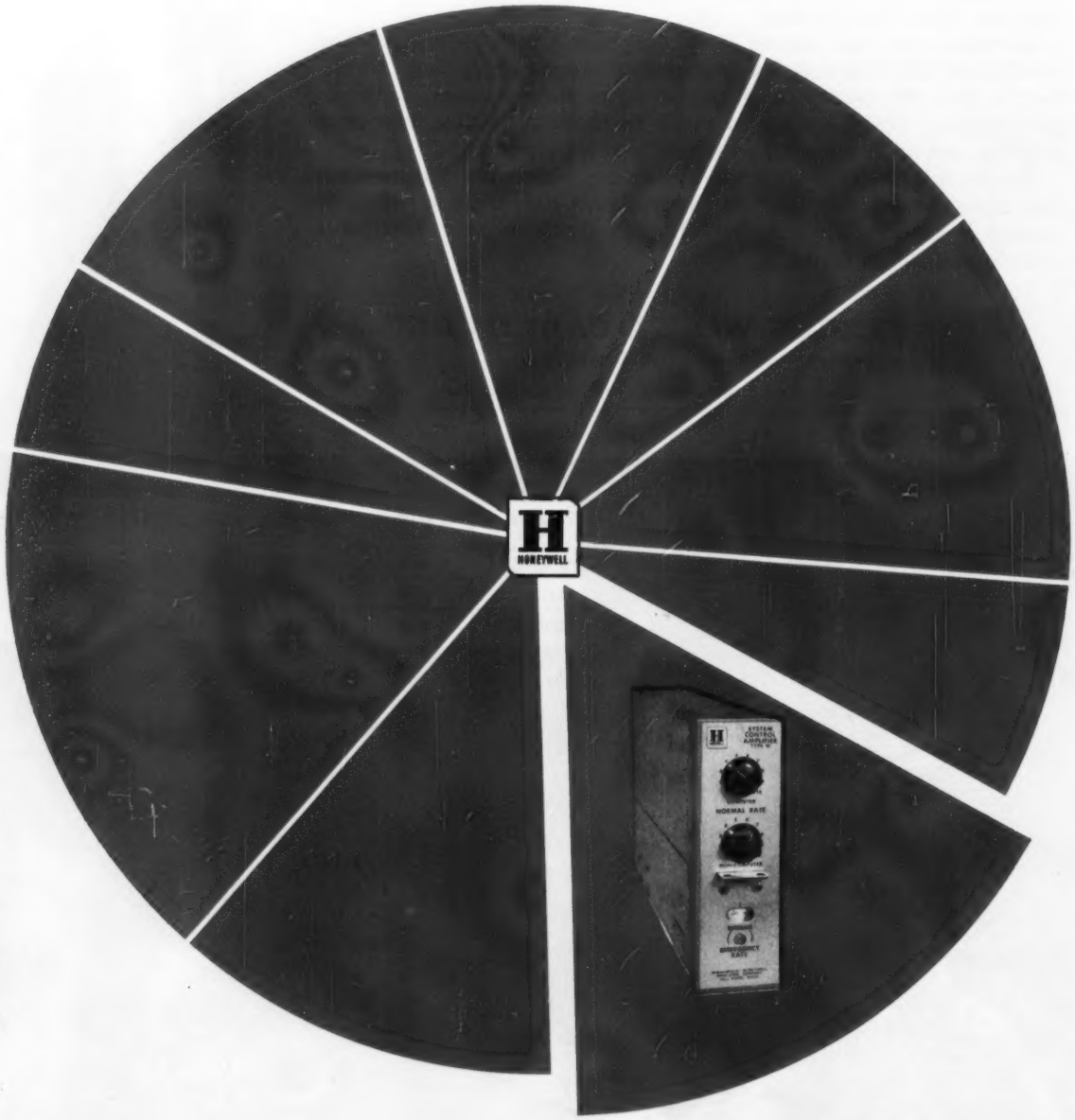
CIRCLE WIRE & CABLE CORP.
SUBSIDIARY OF **CERRO CORPORATION**

PLANTS: Maspeth and Hicksville, N. Y. **SALES OFFICES & WAREHOUSES:** In all principal cities.
Rubber Covered Wires & Cables • Varnished Cambric Cables • Plastic Insulated Cables • Neoprene Sheathed Cables • "CIRTUBE" EMT

CABLE SIZE	RATED VOLTAGE	DOUBLE AC TEST VOLTAGE	CIRCLE B'KDN VOLTAGE	MAXIMUM STRESS IN VOLTS PER MIL
2 AWG	5KV	28KV	48.3KV	454
1/0 AWG	5KV	28KV	40.3KV	356
500 MCM	5KV	31KV	44.6KV	307

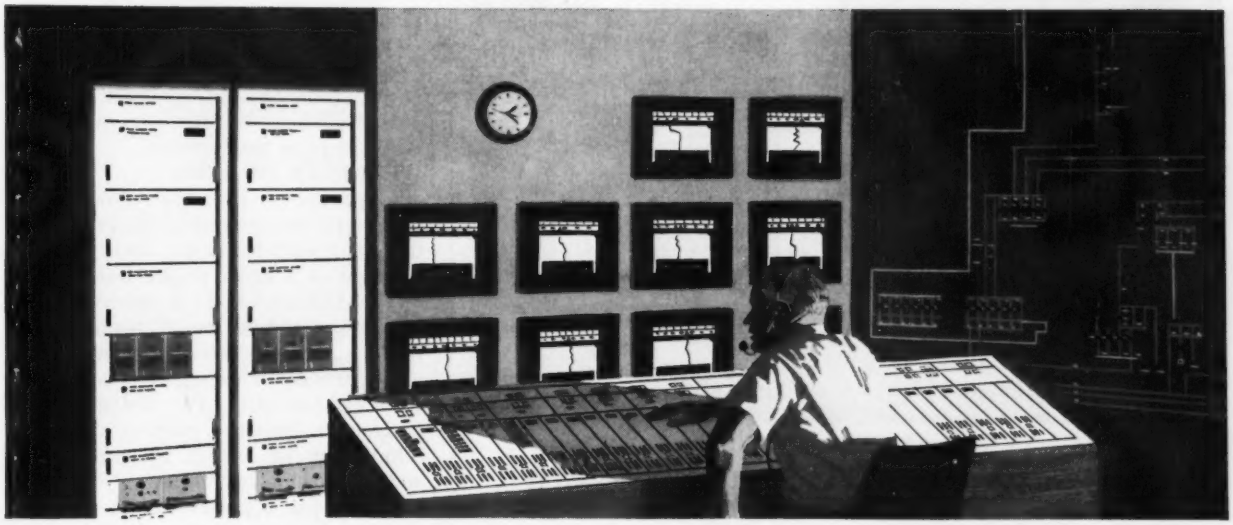
Only Honeywell's new load-frequency system gives you all three:

SOLID-STATE COMPONENTS, RATE LIMITERS



HEART OF THE SYSTEM is this transistorized control amplifier. One basic amplifier performs various computing, measuring, alarm and control functions. Speed of response is easily changed with the turn of a knob. Six amplifiers like this can be mounted in a single standard 19-inch relay rack.

AND COMMAND ACTION



Meet power demands precisely and cut generating costs with Honeywell's new load-frequency control system. It introduces solid state techniques that bring new reliability levels and new performance flexibility and sharply reduce maintenance.

Major components: High-speed, transistorized telemetering equipment transmits tie-line loads to the dispatcher and the command signal to generating stations. Control amplifiers perform computing, measuring, control and high and low alarm functions. Governor motor actuators control generator loading in accordance with command signals. Rate limiters, independent of the control system, hold generation changes within prescribed allowances. Incremental loaders apportion generation on an economical basis.

Easy maintenance: All components are of interchangeable, plug-in, modular design, and are easily accessible while the system operates. Except for relays, *there are no moving parts in the entire system.* Slidewires, motors, gear trains, and vacuum tubes are eliminated. Use of transistors and other solid-state devices throughout cuts space requirements in half and drastically reduces heat buildup. All critical test and calibration points are compactly packaged in a single module, to provide a centralized test area and further simplify maintenance.

Honeywell's new load-frequency control system is a development of first importance in the power industry. For advanced systems, you can add the new Honeywell 290 industrial digital computer to mastermind the system and simultaneously compute cost data for interconnection billing. Get complete details from your nearby Honeywell field engineer. Call him today . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL, Pottstown, Penna. In Canada, Honeywell Controls, Ltd., Toronto 17, Ontario.

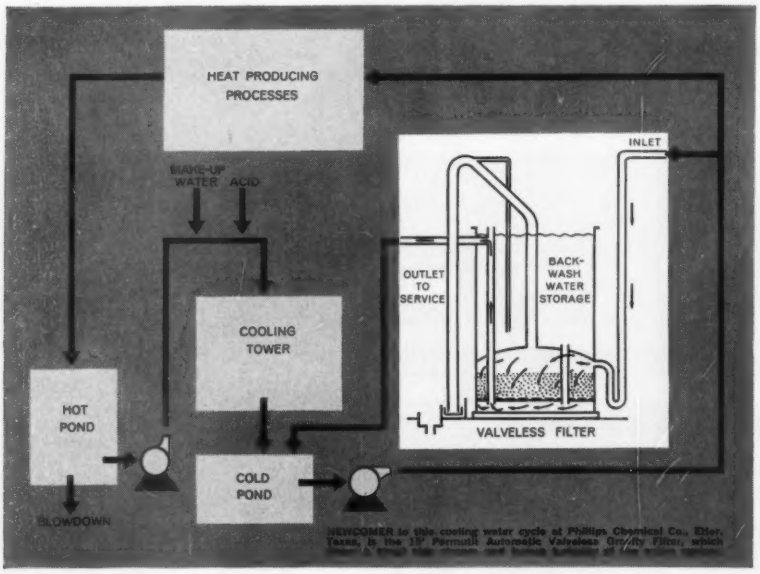
Honeywell

First in Control

SINCE 1885

HONEYWELL INTERNATIONAL Sales and Service offices in all principal cities of the world. Manufacturing in United States, United Kingdom, Canada, Netherlands, Germany, France, Japan.

FLUIDICS* AT WORK



NEWCOMER to the cooling water cycle at Phillips Chemical Co., Sweeny, Texas, is the 15' Permutit Automatic Valveless Gravity Filter, which filters a small side stream and backwashes automatically when necessary.

New way to shrink yearly maintenance costs—improve heat exchanger operation

Here is a new wrinkle in cooling-tower operation:

Side stream filtration. It can appreciably cut your yearly bill for cleaning fouled heat exchanger surfaces and condenser tubes.

Between the cooling-tower and the heat-exchange operation stands a newcomer to the system—a Permutit® Automatic Valveless Gravity Filter.

Its job is to clean up a small portion of the main cooling water stream, roughly 1% to 5%. By continuously filtering this small side stream the turbidity of all the cooling water is reduced and held to an acceptably low level.

In the system shown here, suspended matter dropped from 2.0 ppm to 0.5 ppm in just one week, and continued to decrease thereafter.

Less turbidity in the cooling water means less fouling of heat exchange equipment. Less fouling, fewer cleanings, more efficient operation.

Costs nothing to operate: To sweeten your savings a little more, the Permutit Valveless Gravity Filter is automatic, in every sense of the word. It operates itself, backwashes itself. Has no moving parts, requires no attendant, no power, no extra pumps. The water used to wash serves as part of the system blow-off—at no extra cost.

Now in use: Proved in this new application, the Permutit Automatic Valveless Gravity Filter is already saving money for several companies.

All you need, to join them, is a little space near your cooling tower, and a Permutit Automatic Valveless Gravity Filter. For more facts, write: Permutit Division, 50 West 44th Street, New York 36, New York.

*FLUIDICS is the Pfaudler Permutit program that integrates knowledge, equipment and experience in solving problems involving fluids.

PFAUDLER PERMUTIT INC.

A world-wide company with plants in Germany, Great Britain, Canada, Mexico, Japan, as well as the U.S.A.

Meter Conference

(*Continued from p* 70)

resistance change into a polarized signal to cause alternate switching of two silicon controlled rectifiers. The rectifier configuration is such that it replaces the conventional 3-wire contacts of present contact devices or relays.

The D-43 impulse generator will provide the performance of the D-41 impulse generator without the use of contacts which might eventually require maintenance.

IPE METER READER . . .

Engineers of Industrial Process Engineers, Inc, presented details on the function, hardware and advantages of a meter reader system.

The IPE system is a means of collecting utilities' meter readings from industrial, private dwelling, and apartment house meter clusters by telephone link. The system is designed to produce meter-reading information for use in accounting and dispatching operations.

The system applies to all or any variety of conventional meter devices and is said not to impair metering accuracy. It produces checked, punched paper tape and/or typewritten records of the collected readings. Regardless of whether the records are in tape or typewritten form, each reading is identified by a meter number, followed by the actual meter reading.

The normal maximum time requirement for any reading transmission is 1.5 sec. Other features of the system include a very low installed cost for each meter point, and an ability to use low tariff telephone company data-transmission methods. IPE says that a test facility will be installed on General Telephone Co's system before the year is out.

SANGAMO MAGNETIC FLOTATION METERS . . . Sangamo Electric Co announced that the magnetic flotation moving system, first introduced at the fall 1960 meeting in the Type J3, was being expanded to the complete line of single-phase and polyphase meters. In the past six months, these developments have been completed and the company is now in production on all variations of single-phase and polyphase watthour meters with magnetic flotation.

(*More Manufacturers' News p* 76)

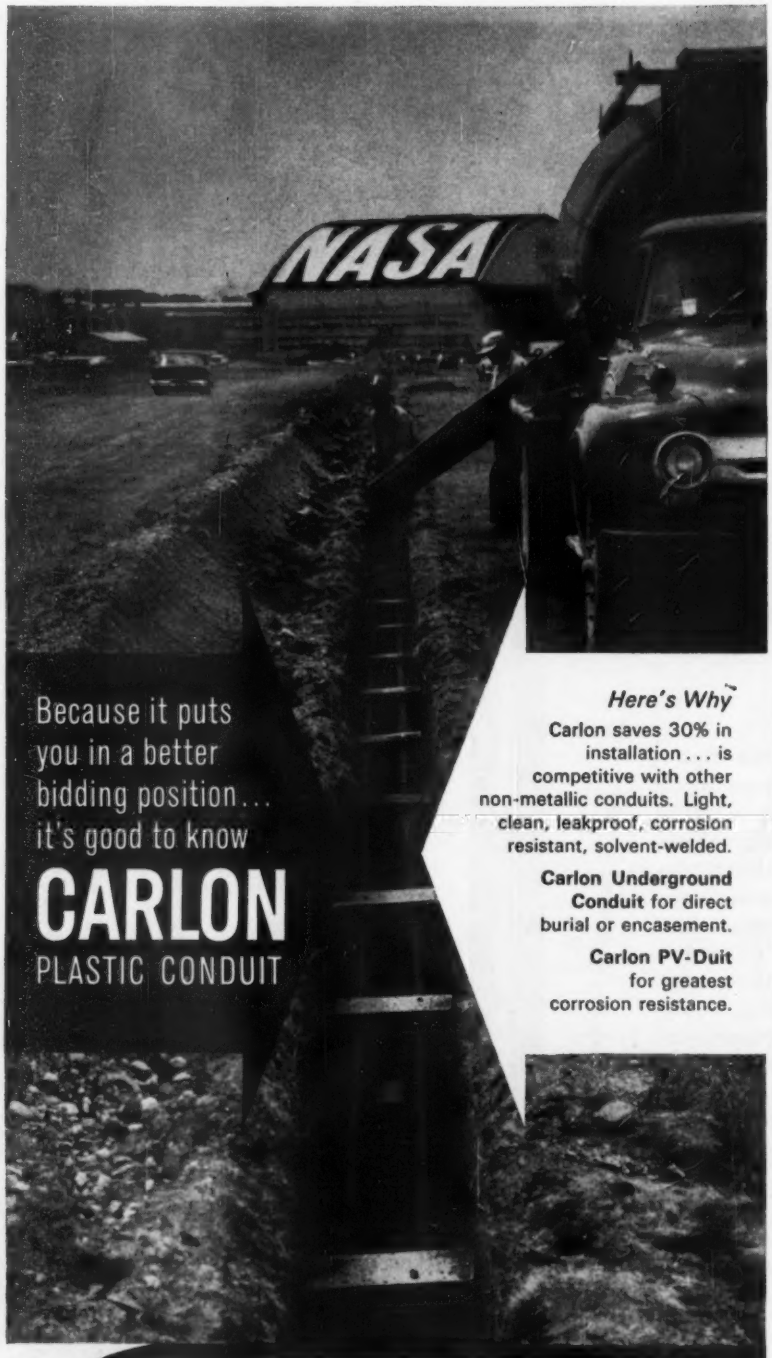
Original "straight-through" design

This "look" on a pole means KPF

There's no mistaking the clean, pleasing pole top appearance of KPF switches—the original "straight-through" design. This design means lower cost, trouble-free service, no lubrication, virtually no maintenance. Installation may be made in the air or on the ground, on hot or dead lines, with phase units in horizontal, triangular or vertical array. Installation time is half that normally needed; no extra dead end insulators or heavy extra mounting structures are required.

Test install a KPF switch on your system this month.

KPF ELECTRIC CO.
P.O. Box 1257E, Stockton, California
HOward 4-8381 • Area Code 209



Because it puts you in a better bidding position... it's good to know

CARLON
PLASTIC CONDUIT

Here's Why

Carlon saves 30% in installation . . . is competitive with other non-metallic conduits. Light, clean, leakproof, corrosion resistant, solvent-welded.

Carlon Underground Conduit for direct burial or encasement.

Carlon PV-Duit for greatest corrosion resistance.

KNOW THE FIRST NAME IN PLASTIC PIPE
CARLON

GET THE FACTS

Carlon Products Corporation
Box 133 — Aurora, Ohio **Dept. EW-1**

☐ Send me complete information at once.
☐ Have your representative see me regarding Carlon Plastic Conduit.

NAME_____ TITLE_____
COMPANY_____
ADDRESS_____
CITY_____ STATE_____

TVA 900-Mw Equipment Contracts Are Resolved

TVA recently announced the award of a contract to Combustion Engineering, Inc, Chattanooga, for the boiler for one of two new 900-Mw steam turbogenerators now on order. The contract includes an option for another boiler for the second unit, which may be exercised on or before July 1, 1962. The contract price is $17,440,000 for one boiler and $34,660,000 for two. Award was made on the basis of the low bid.

At the same time, TVA announced that it has accepted an alternative design offered by General Electric Co for the two turbogenerators on order. The change will increase the guaranteed gross capability of the units by 35 Mw to 900 Mw each, and will add $1 million to the cost of each unit, bringing the total cost for the two to $32,764,000.

The first of the two units is scheduled for operation by fall of 1964, the second a year later. Plant site has not yet been selected—eastern Kentucky on the Cumberland and eastern Tennessee on the Clinch are being considered.

The boilers will deliver 6,100,000 lb of steam per hr to the generators, at 2,400 psi, 1,050F.

The turbogenerators will be of the cross-compound type—each 900-Mw plant will consist of two units operating side by side on the same steam system. According to reports at press time, the turbines will operate at 1,800 rpm.

New $25-Million Nuclear Corporation Is Announced

Plans for a new $25-million corporation which will be the nation's first integrated organization in the field of nuclear energy were recently announced by three leading companies in the nuclear field—Olin Mathieson Chemical Corp, Nuclear Development Corp of America (NDA) and Mallinckrodt Chemical Works.

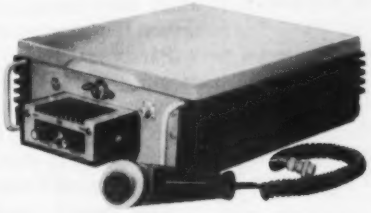
The new company, to be called United Nuclear Corp, will combine the facilities and personnel of NDA, Olin's Nuclear Fuels operation, and the Mallinckrodt Nu-

RCA "LD" 2-way radio has the guts to stand up to the toughest jobs!

There are rugged places where men, trucks and 2-way radios have to go, and each has to be a proven, reliable performer. In 2-way radio, this means quality must be built-in to take the gaff—quality such as only the leader in radio and electronics can offer—in the new RCA "LD" (Low battery Drain). Quality and price are combined in this dependable RCA equipment to give you the very best performance at the lowest cost. Use it on the roughest roads—Security Sealed Circuits are your assurance it can take it. Leave the radio on when your vehicle engine is turned off—battery drain is negligible—transistors are used in circuits where they have been proven to be most dependable.

It took experience and daring to bring you today's RCA 2-Way Radios. It meant discarding preconceived notions about circuits and redesigning with transistors in key places for reliability with economy. And it involved engineering a host of other advanced features to assure fine message intelligibility, and long component life at moderate cost.

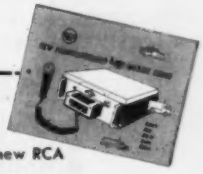
Your RCA Communications Specialist will be glad to show you why the "LD", dollar for dollar, feature for feature, is today's greatest 2-way radio value. Or send coupon for further facts.



RCA

The Most Trusted Name in Radio

RADIO CORPORATION OF AMERICA



RADIO CORPORATION OF AMERICA
Telecommunication Center, Dept. SD-45
Meadow Lands, Pa.

☐ Please send me FREE literature on the new RCA Transistorized Mobile Radio.

☐ Have RCA Communications Specialist contact me and explain why this is today's best value in 2-way radio.

NAME_____ TITLE_____

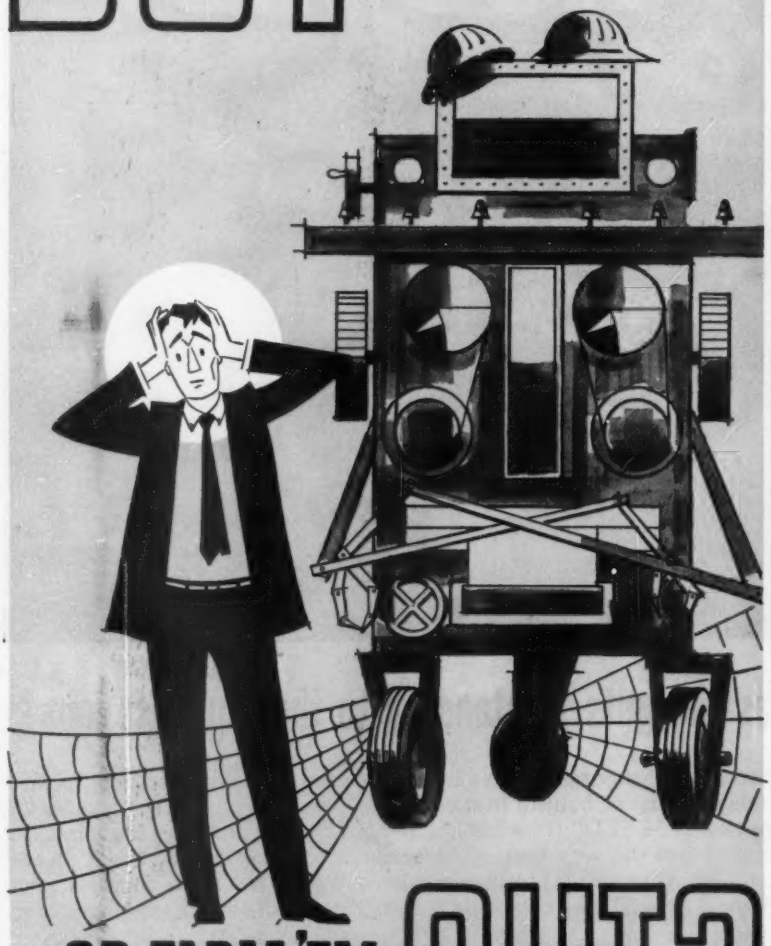
COMPANY_____

TYPE OF BUSINESS_____

ADDRESS_____ PHONE_____

CITY_____ ZONE____ STATE_____

BUY HEADACHES?



...OR FARM 'EM OUT?

Your job's generating and transmitting electricity, not house-keeping for equipment you can't keep busy full time. Avoid headaches. Call in a qualified electrical contractor. He offers—

- Equipment and skilled men *when and where needed*
- Extra facilities in emergencies
- Reliable job completion dates
- Firm bids on job costs
- Written performance guarantees

For names and addresses of NECA qualified contractors near you, write
National Electrical Contractors Association
610 Ring Building, Washington 6, D.C.

NECA

clear Div, Commercial Operations, at St. Louis and Hematite, Mo.

At the time of formation of the new company, Olin will be the majority shareholder. William C. Foster, currently a director and vice president of Olin, will be president of United Nuclear, which will have a total employment of approximately 1,400 persons.

The United Nuclear Corp will serve both commercial and government customers. It will have skills and facilities for research and development, reactor system design, manufacture of nuclear fuel materials, reactor and core fabrications, fuel management, cold scrap processing, isotopes and hot radiation energy sources. It will also have personnel skilled in hot core transportation, hot scrap reprocessing and hot waste disposal.

Contracts Placed for Second 2,000-Mw British Plant

Last week Britain's Central Electricity Generating Board announced the letting of equipment contracts for a new 2,000-Mw West Burton Power Plant (EW, March 20, p 76) —International Combustion, Simon-Carves Ltd and English Electric Co, Ltd, divided equipment contract orders totaling $95.2 million. Following closely on the heels of this announcement, the Board this week announced that they are placing orders for a second 2,000-Mw power plant, valued at $92.4 million.

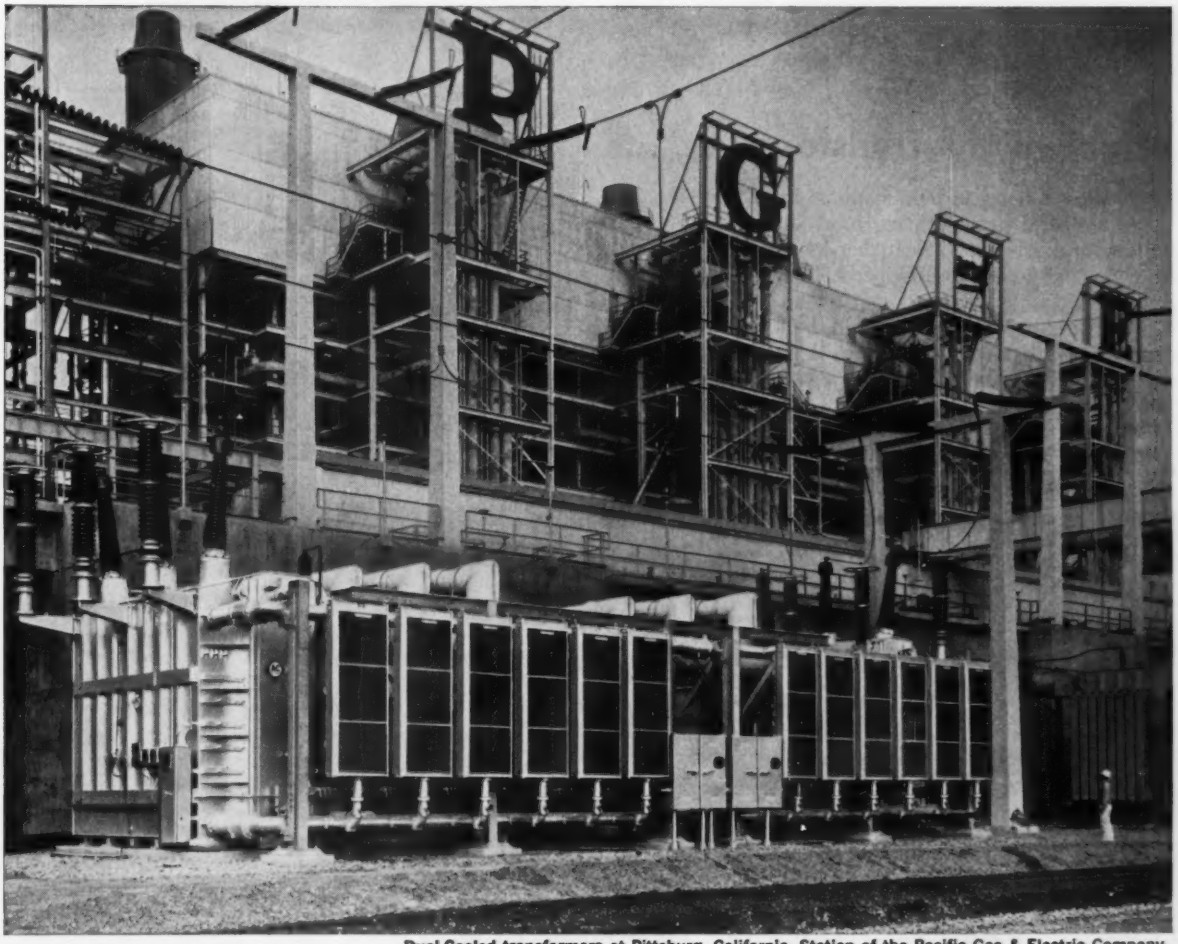
Babcock & Wilcox Ltd will supply the four major coal-fired boiler units valued at $56 million. The boilers will be of the Babcock radiant-type, fired with pulverized coal.

C. A. Parsons Co, Ltd, will supply the four 500-Mw turbogenerators, feed-heating plant and turbo-driven feed pumps for $36.4 million.

Parsons officials said the generators were equivalent to an increase of more than 6% in Britain's generating capacity. U.K. electricity consumption is currently expanding at the rate of about 7% annually.

The board has been studying several sites for new power stations in the east midlands and Yorkshire, and the new plant is believed likely to be located in one of these areas.

ALLIS-CHALMERS



Dual-Cooled transformers at Pittsburg, California, Station of the Pacific Gas & Electric Company.

Hidden transformer capacity uncovered!

Dual-Cooled* transformers boost emergency capacity 33% without loss of life

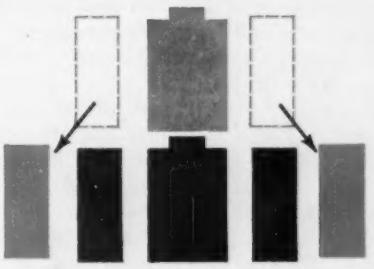
Dual-Cooled transformers — an A-C development — are utilized at this central station to permit two-thirds of the turbine output to be carried in the event one transformer is off the line. In an emergency, cooling equipment from both units is connected to the functioning transformer. Result: Capacity of either unit with dual-cooling is increased one-third over its normal rating.

For substations under gradual load growth conditions, the *Dual-Cooled* transformer capacity bonus can defer purchase of additional units. Smaller transformers can be installed without paying for little-used standby capacity. You save on installation costs, on real estate, fencing, concrete and taxes.

Dual-Cooled transformers are available in any rating from 20,000 kva up. Contact your conveniently located A-C office or write **Allis-Chalmers,** Power Equipment Division, Milwaukee 1, Wisconsin.

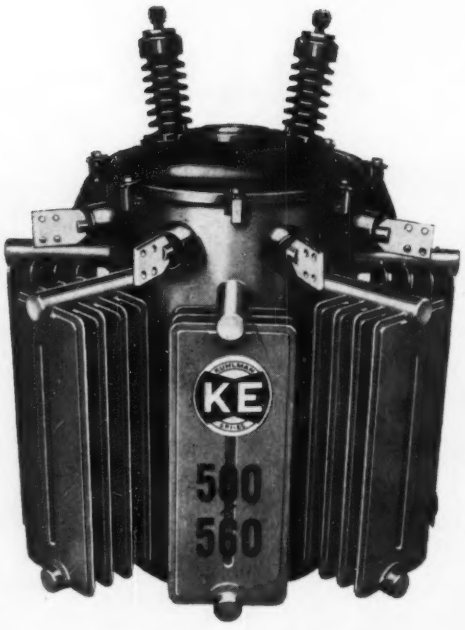
A-1426

*Dual-Cooled is an Allis-Chalmers trademark



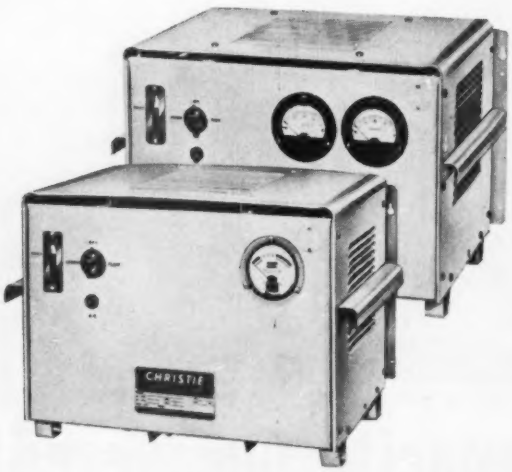
Another method of dual-cooling is the physical transfer of coolers from one transformer to the other.

New Equipment



Lightweight Transformers . . .

. . . allow a boost in pole-mounted kva. The 500, 333, and 250-kva transformers have dual ratings which allow operation at 12% higher kva without sacrificing service life—losses are reduced 32%, 29%, and 29%, respectively, from previous designs. Weight of the 500-kva unit is held to 3,100 lb, half the weight of the previous design, and the height is only 50 in. Weight of the 333-kva unit is cut 50% and height is shrunk to 46½ in. The weight of the new 250-kva transformer is halved and its over-all height is only 32 in.
Kuhlman Electric Co, Birmingham, Mich.

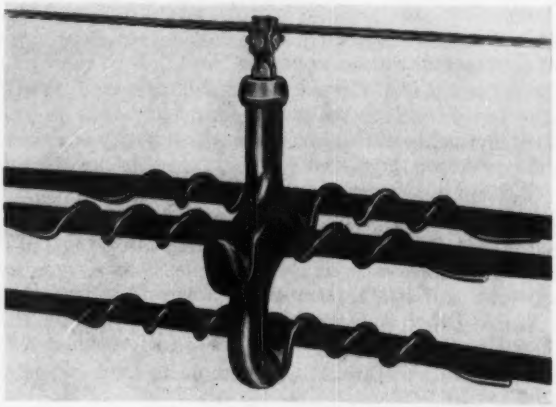


Battery Chargers . . .

. . . are for five types of applications: lead-acid, nickel-cadmium, silver-zinc, silver-cadmium or nickel-iron batteries, and are automatic. Stepless automatic battery charger Models BC 24-50, BC 32-25 and BC 120-6 cover a wide range of voltage and current ratings, with special characteristics available for all applications from float-charging batteries for emergency lighting and control service to heavy-duty lift truck or electric vehicle charging. Hermetically sealed silicon rectifier elements are said to offer maximum efficiency combined with virtually unlimited years of service without component aging. The magnetic amplifier regulating system, which uses no moving parts or electronic tubes, is said to provide precise control, optimized charging rate, and unsurpassed reliability.
Christie Electric Corp, Dept BC, 3410 W 67 St, Los Angeles 43, Calif.

Porcelain Spreader . . .

. . . has universal or swivel-type mechanical connection at the neutral to provide permanent positioning for spacer-type aerial construction. The S-2 is a one-piece body of high quality, wet-process, glazed porcelain designed for complete hot stick installations at either 5 or 15 kv. Conductors are firmly and readily positioned with rigid polyvinyl chloride, factory-formed tie rods. Impulse, flashover and RIV tests are comparable with other 15-kv equipment. Minimum dead-weight rating of the porcelain is 2,500 lb.
Fargo Mfg Co, Inc, Poughkeepsie, N. Y. (Distributed by Line Material Industries, Milwaukee, Wis.)



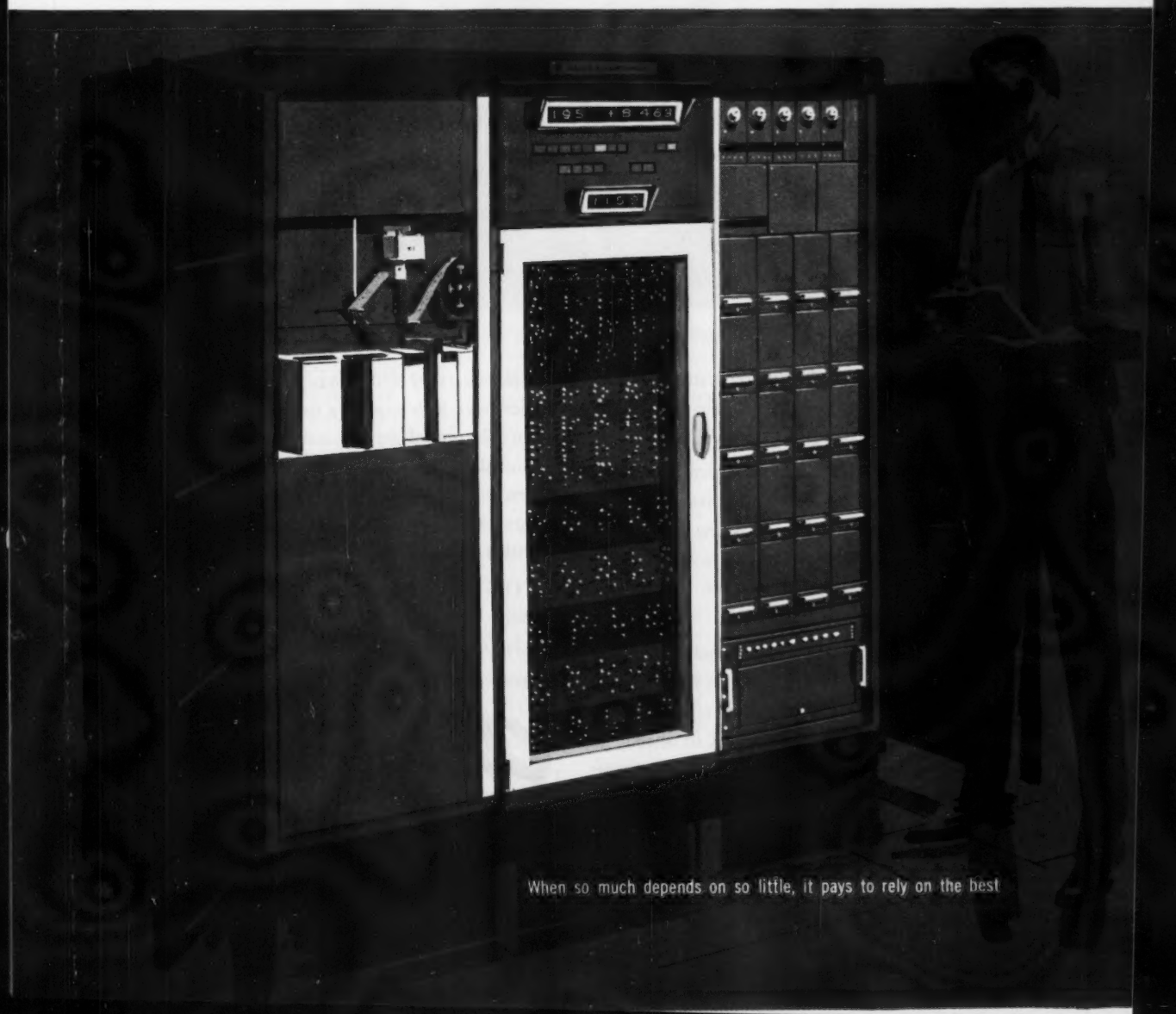
(More New Equipment on page 83)

Enter the digital field with confidence: you can now get precise performance analysis data . . . protective monitoring for boilers, turbines, generators, transformers, etc. . . . with a solid state data system engineered by Leeds & Northrup to power plant standards. This system gives you the speed, accuracy, flexibility and — above all — the *reliability required by central station operation. Investigate* and confirm for yourself the benefits of L&N low-level measurement technology, L&N application know-how and L&N systems-engineered dependability. Contact your L&N Field Engineer, or 4938 Stenton Avenue, Philadelphia 44, Pa.

NEW | LN2000

Solid state data systems for central station operation

LEEDS & NORTHRUP *Pioneers in Precision*



When so much depends on so little, it pays to rely on the best

Can you see any difference?

O-B puts lightning immunity into small pintype insulators--a big added value at no extra price.

Is this just like any other pintype insulator you buy? Does it look the same? Chances are it does.

Take another look. See the scars on the porcelain? These are from repeated electrical discharges many times as severe and destructive as natural lightning. O-B has one of the very few laboratories in the world that can *produce* such a discharge - - and, to our knowledge, the only low voltage pintype that can *take it*.

The combination of unexcelled technical facilities, and a desire to apply these to the development of a low-cost insulator, are unique in the electrical field. The difference isn't in shape, or size, or even price - - the difference is in performance, and in saving the high expense of detection and replacement of lightning-damaged insulators.

Because they seldom have shielding, distribution lines have high exposure to lightning attack. This can't be cured by an insulator, but it can be combated. This is the big extra you get when your lines are insulated with O-B. They don't puncture. They truly do save you money because of this - - a lot of it!

O-B pintypes are as handy to you as your telephone. Graybar can deliver them to your door today if you need them that quickly.

OHIO BRASS COMPANY, MANSFIELD, OHIO

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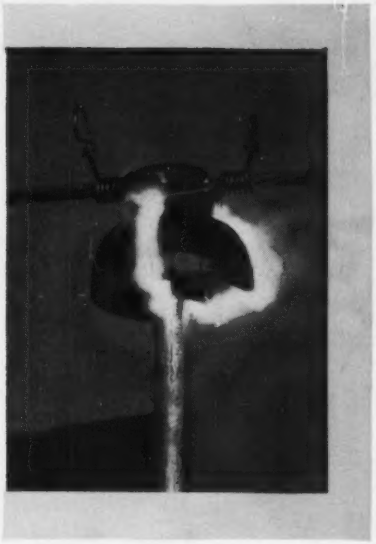


Far more wicked than natural lightning - - this O-B distribution pintype is withstanding an impulse discharge having the phenomenal wave front of 8,000,000 volts per microsecond. Destructiveness of this discharge is many times what can be encountered in service. It will shatter the average insulator but in the case of O-B, it can be applied repeatedly without harm. The insulator on the opposite page shows the result of this extremely severe test. The glaze has been burned by the great heat in the flash, even though its duration was only in the order of 8/100 of one millionth of a second. Otherwise the insulator is perfectly sound. Its full useful life has not been impaired.

When you buy distribution insulators remember what you have just seen. You are also buying the ability of the manufacturer to reproduce the basic design faithfully in large quantities over long periods of time. And you pay nothing extra for this protection to your service.

Air Circuit Breaker . . .

. . . maintains more uniform flux pattern in the interrupting chamber by combining the U and H-designed magnetic air chutes. The 1,000-Mva, 15-kv DST 15-1000 breaker is supplied in 1,200 and 3,000 amp and meets present and proposed accepted test standards. Total interrupting periods are less than 5 cycles for light load to full interrupting capacity of 42,000 amp. Breakers are supplied with either dc solenoid or electric motor-charged stored energy closing mechanisms which are interchangeable. Low-power-factor Polestiglas insulation provides flame-retardant and non-tracking arc chutes and interphase barriers.

Federal Pacific Electric Co, 50 Paris St, Newark, N. J.

Ultrasonic Cleaning Equipment . . .

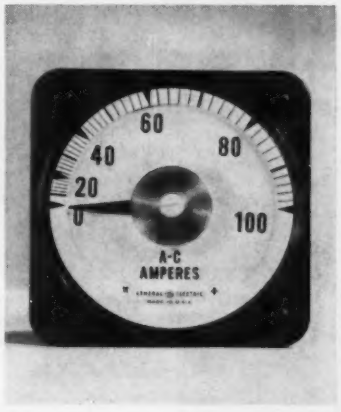
. . . features a new configuration, allowing ultrasonic power to be applied simultaneously to three or more containers. The unit may be used in utility research laboratories and meter shops. Each container can be filled with a different fluid so that small parts or movements can be successively washed, rinsed, final rinsed. Effects on various materials are seen simultaneously.

Ultrasonics Corp, 10909 Venice Blvd, Los Angeles 34, Calif.

Panel Instruments . . .

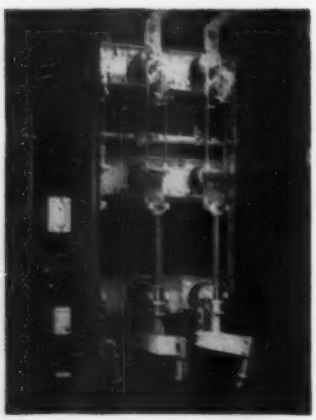
. . . have 1% accuracy range on 180-deg scale and feature excellent readability. Type AB-30 includes voltmeters, ammeters, frequency meters, wattmeters, varmeters, power factor meters, and synchroscopes; type DB-30 ammeters and voltmeters are also available. Scale length is 5.1 in., the same as that of larger rectangular switchboard instruments.

General Electric Co, Schenectady 5, N. Y.

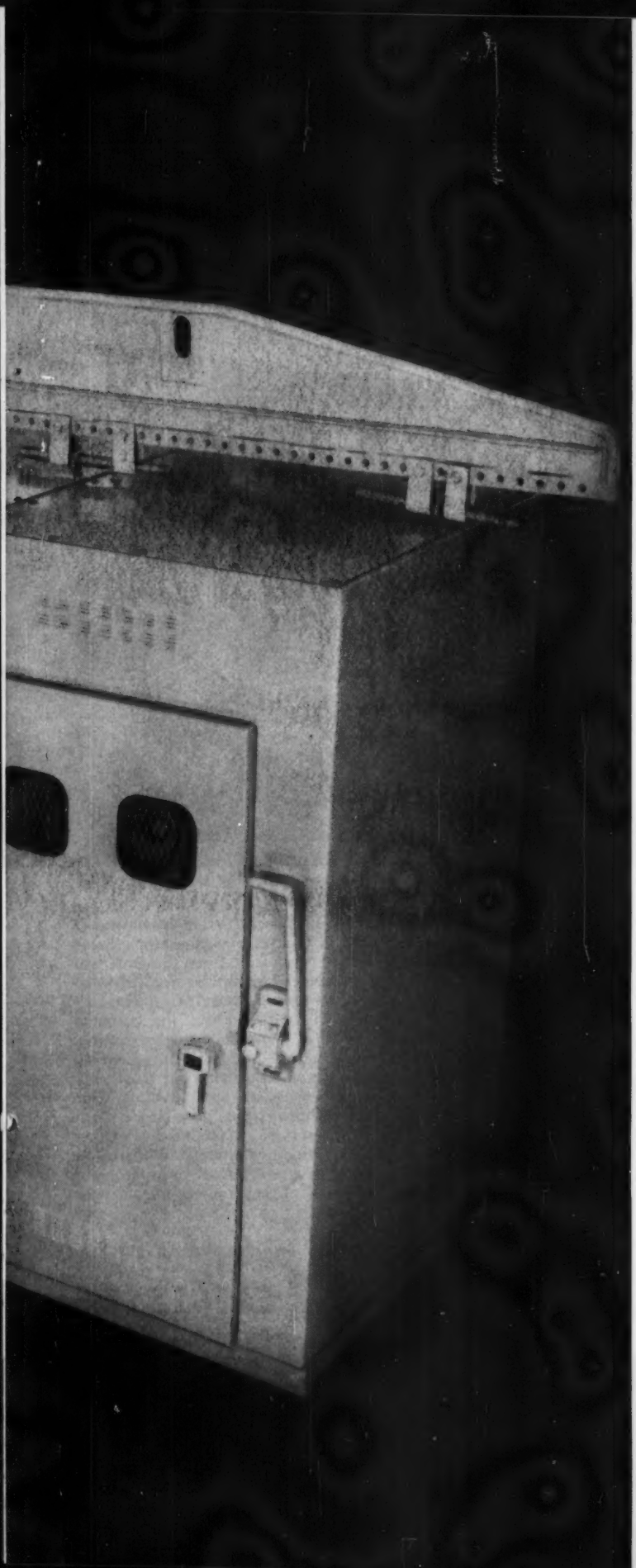


FAULT PROTECTION

ONLY 125 LB. PER SQ. FT.



Inside view of typical bay, showing load interrupter (for switching), power fuses, and out-going pothead.



S&C Metalclad Switchgear weighs 60% less — requires 50% less floor space

This S&C Metalclad Switchgear unit, rated 13.8 kv, weighs only 4500 lb., requires only 36 square feet of floor space (excluding aisle space), yet costs only $5,000. Why? Through the simplicity of S&C's design. Power fuses provide fault protection and load interrupters do the switching. Result: the most dependable yet most economical protection possible for high voltage power circuits in industrial and commercial installations. Besides initial low cost here's how else you save:

Low installation costs. Because S&C switchgear is lighter it's easy to uncrate, handle and move into place. Often you can utilize space on roofs or balconies without the expense of reinforcing. The S&C unit shown here weighs only 125 lb. per square foot—60% less than other types of metalclad switchgear.

Less floor space. S&C switchgear is shallower. (The unit shown here is only three feet, eight inches deep.) It can be backed against a wall since rear access is not required. No extra floor space is needed at the front for drawout. So you can cut your floor requirements 50%.

Power fuses give protection against permanent destructive faults. Industrial and commercial high-voltage power circuits are not subject to transient faults and so don't need the automatic reclosing feature of the circuit breaker.

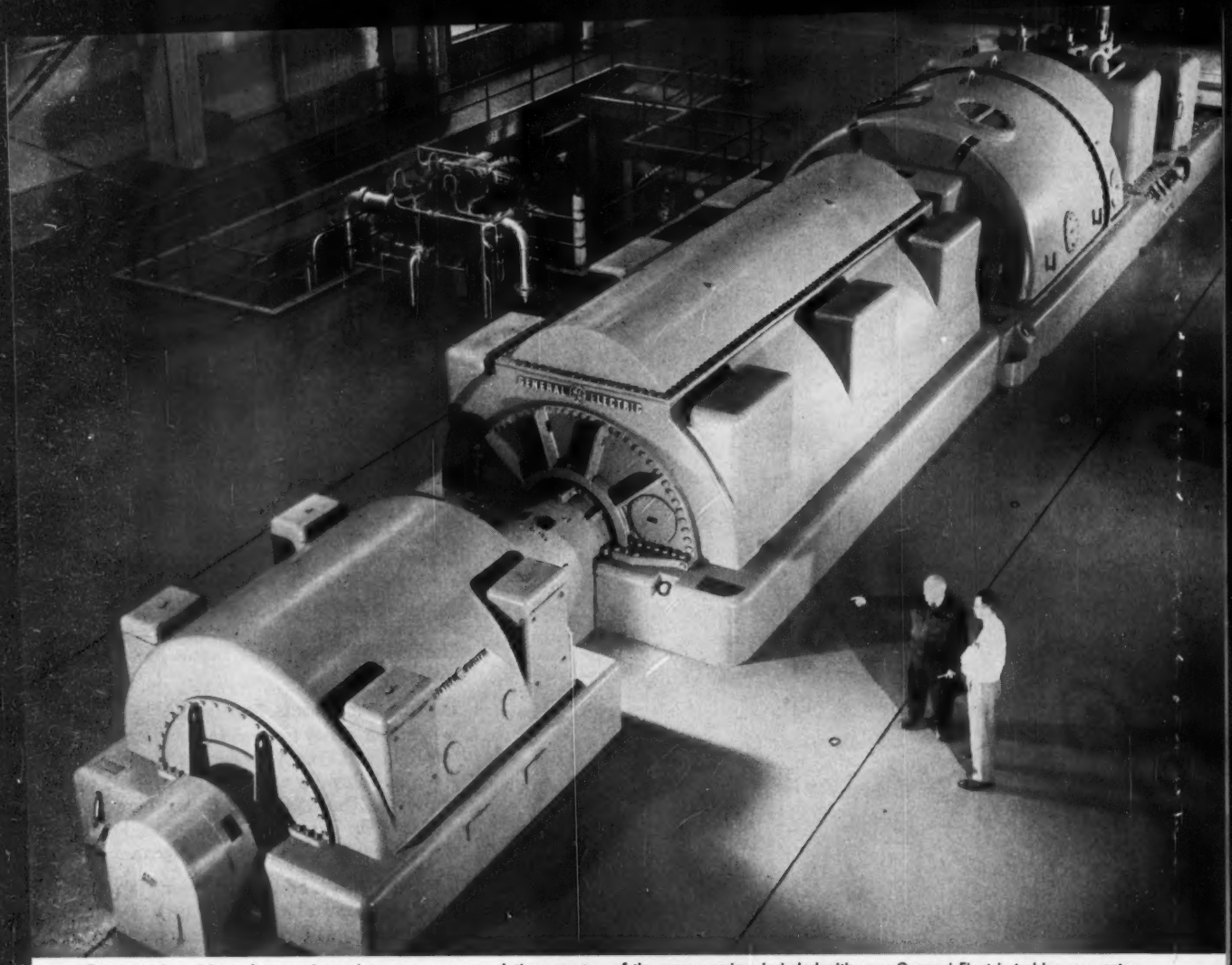
S&C fused interrupter gear meets the new National Electrical Code requirements for fault closing. It is available in short circuit interrupting ratings up to 500 mva at 14.4 kv, 250 mva at 4.16 kv. Continuous current ratings are 200, 400, and 720 amperes. Maximum capacity of main bus, 2000 amperes.

S & C ELECTRIC COMPANY

4421 Ravenswood Avenue • Chicago 40, Illinois

Specialists in High Voltage Circuit Interruption since 1911

S&C



Frequent plant visits and preventive maintenance recommendations are two of the many services included with your General Electric turbine-generator.

Service . . . an integral part of your General Electric turbine-generator

For as long as your General Electric turbine-generator is on the line, members of your G-E turbine-generator service team . . . who have followed your unit from the time you placed the order, through design, manufacturing, installation, and start-up . . . frequently visit your power plant.

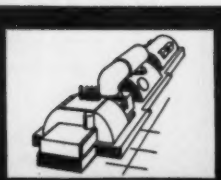
During these inspection visits, they check the unit and evaluate its performance with you and your operating, maintenance, and engineering personnel. They recommend planned preventive maintenance based on your most convenient down-time. Then they assist you in getting your unit back on the line in the shortest time possible.

In addition, your G-E service team makes recommendations . . . based on the findings of General Electric's continuing design analysis program . . . to improve your unit's performance. They do all this . . . for as long as your turbine-generator is on the line. 244-06

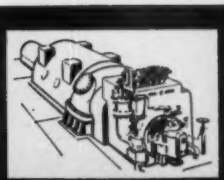
Progress Is Our Most Important Product

GENERAL ELECTRIC

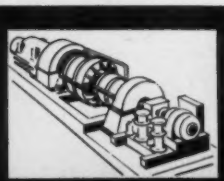
General Electric Turbine-Generators Help Keep Power Costs Low



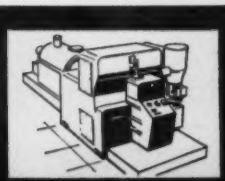
Steam turbine-generators for large blocks of power



Steam turbine-generators 100,000 kw and lower



Gas turbines for peaking, base load, combined cycles



Mechanical drive steam turbines for auxiliaries

Electrical World

MARCH 27, 1961

Management Newsletter

The Economy—Out of the Woods?

The economy is in sad shape, according to the comments that came out of Washington during February. Secretary of Labor Arthur Goldberg toured the country and pronounced the situation a "full-fledged recession." Sam Rayburn was more specific. "The current situation," he said, "is the most urgent since the great depression." Even the President, speaking at a press conference, saw little reason for optimism and stressed the importance of quick action on his emergency relief measures.

Against this somber background painted by the leaders of the "New Frontier," the activity on Wall Street seemed as out of place as a jazz concert in a mortuary. Beginning in November the market rallied, and with feverish activity posted gains in March of about 20% above the 1960 low. Washington politicians and New York investment advisers seemed to be talking about two different countries when it came to dissecting the economy. To one, the nation was bedridden and growing weaker. To the other, the country had a slight cold but was feeling better by the minute. Somewhere in between, the real American economy was wandering unnoticed.

One way of finding just how bad the current recession is would be to compare it with the post-war setbacks of the past. Naturally, the levels of most indicators are higher now because the nation has been following an over-all trend of growth even though the growth has not been rapid enough to please many economists. But we can measure the amount of drop that took place during each of the postwar slumps, and ask ourselves if we have fallen further in the Sixties than we did in the Forties and Fifties. The comparison looks like this:

How Bad is the Recession?

	1949-50	1953-54	1957-58	1960-61
Gross National Product (billions of dollars)**	High 265.9, Low 256.4, % Change −3.6	High 368.8, Low 358.9, % Change −2.7	High 448.3, Low 432.0, % Change −3.5	High 505.0, Low 500*, % Change −1
Industrial Production (1957 = 100)**	High 69.1, Low 62.2, % Change −10	High 93.5, Low 84.0, % Change −10	High 101.5, Low 87.1, % Change −14	High 111.0, Low 100*, % Change −10
Inventory Accumulation (billions of dollars)**	High 6.1, Low −5.3, Change −11.4	High 5.3, Low −4.6, Change −9.9	High 6.2, Low −6.9, Change −13.1	High 11.4, Low −3.0, Change −14.4
Unemployment (% of civilian work-force)**	maximum level 7.8, Month — Oct.	maximum level 6.2, Month — Sept.	maximum level 7.5, Month — July, Aug.	maximum level 6.8, Month — Dec.

*estimated, **seasonally adjusted figures

The number of minus signs and the high level of unemployment show clearly that the economy has been skidding. But a comparison with the drops of previous recessions makes the attitude in Washington seem a bit pessimistic. The present slump has not yet reached the proportions of any of the other post-war recessions. It has been the mildest one yet.

If the slight drop in Gross National Product were spread evenly throughout the business community, its effects would hardly be perceptible. But this isn't the case. Some areas of the economy are enjoying all-time highs. These are industries providing consumers with soft goods and services. It's the manufacturers of durable goods who are bearing the full brunt of the setback. And no comparisons with the past can convince them that the 1960-61 recession is less then serious.

Expenditures for new plant and equipment have dropped $1.4 billion from a high of $36.3 billion per year in the second quarter of 1960. Manufacturers of automobiles, appliances, and other consumer durables, whose sales were sliced by $1.3 billion during 1960, find little comfort in the fact that consumers are still buying soft goods and services. And the 5.4 million men out of work probably don't care that things aren't quite as bad as they've been before.

Areas of the economy which service the hard-hit industries are also feeling some of the recession's effects. Railroads and truckers are pinched by the 11% drop in carloadings, and electric utilities experienced kwhr sales in March that were below the 1960 figure. According to the Edison Electric Institute, kwhr sales in the central industrial region have been as much as 7.1% below last year.

Granted that the over-all picture isn't nearly as gloomy as Administration spokesmen have been making it out to be, we are still faced with substantial sectors of the economy that are in serious trouble. To these people the important question is not "are we worse off than we were in '58?" It's "when is this thing going to end?"

While there is no definite proof that the recession has run its course, there are now some signs that lead to optimism. First of all is the complete about-face in Washington. Cabinet officers who just a few weeks ago were painting a picture of doom have begun to smile. Secretaries Dillon of the Treasury, Hodges of Commerce, and even Goldberg of Labor now see the upturn coming during the second quarter.

Leading indicators have pointed upward with varying degrees of certainty. The stock market, generally regarded as being three to six months ahead of movements in the economy, started moving upward late in 1960 and has continued its rally throughout the first quarter of 1961. Seasonally adjusted figures for weekly hours of work in manufacturing turned up slightly in January. This included both durable and non-durable goods. Sales of durable goods were up 1% in February, and new orders posted a 2% gain. The McGraw-Hill Machinery New Orders Index, based on the new incoming business of a very large segment of the machinery manufacturing industry, rose in January for the first time in six months. Of course, a one-month rise is hardly a trend. But the figure becomes more significant when viewed in the light of the other leading indicators which have been rising.

Some of the coincident indicators are beginning to show signs of strength. The Industrial Production Index, which had moved generally downward from its January 1960 high, and which had fallen severely through the second half of 1960, finally ended its plunge. Preliminary figures seem to indicate that in February the index maintained its January level. Naturally the level itself is disheartening, but businessmen know that before you can start a recovery, you have to end the slide. The production index figures for February hint that the slide may be ending.

Another coincident indicator, non-agricultural employment, is looking a bit better. The seasonably adjusted figure fell very slowly throughout the second half of 1960, but in January it picked up slightly. Again, the one-month figure is nearly meaningless except when considered along with the other benchmarks which have shown some strength.

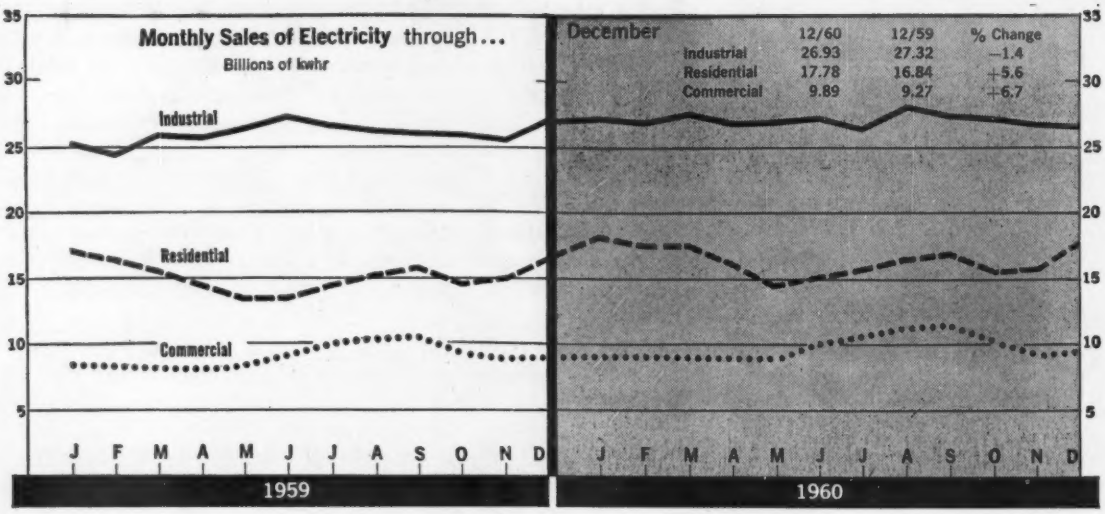
There are also solid signs that the rate of inventory liquidation will soon taper off. For one thing, ratios of inventory-to-sales and inventory-to-new orders in the durable goods industries have not risen sharply in recent months. Inventories of purchased materials have already been cut substantially, and stocks of finished goods are also declining. The inventory depletion should, therefore, slow down from its rapid pace of recent months. Change in inventory policy toward a substitution level would, of course, narrow the gap between sales and manufacturing. This would mean that idle machines would be turning once again.

Some economists look at business performance in 1960 and see in it signs of great underlying strength. Business has gone through its biggest post-war swing in inventories with less damage to other economic indicators than we've witnessed in the past. This, they say, shows the diversity of the economy, and its resistance to slumps in any one area. They talk of a new boom beginning in the second half of 1961.

Other students of the economy point to the fact that after each of the preceding post-war recessions, the unemployment rate has never dropped back to its pre-recession level. Rather, the level after the slump has steadied a percentage point or so higher than before. With this in mind, they see a nagging unemployment problem hindering the nation's economic growth even after the current recession has run its course.

It may be under the second school of thought that the Administration, while indicating the end of the 1961 slump, is now stressing the need for long-range economic development. Certainly the economy must improve over its 1958-1960 performance if it is to provide employment for the rapidly swelling labor force.

No one can offer more than a guess as to what the performance of the economy will be during the Sixties. But there is evidence to support at least two conclusions. *First,* the current recession has been to date the mildest of the post-war slumps. *Second,* the end of this recession seems now to be in sight.



Power Statistics

		Latest Month	Year Ago	Annual Change %
Capacity	Dec.	167.48	156.62	6.9
Est. Dec. '60 Peak, million kw	Nov.	133.7	134.0	−0.2
Est. Dec. '61 Peak, million kw	Nov.	143.3	143.3	0.0
Production—billion kwhr	Dec.	66.20	63.16	4.8
Hydro		11.26	12.68	−11.2
Fuel		54.94	50.43	8.9
Sales—billion kwhr	Dec.	57.92	56.32	2.8
Residential		17.78	16.84	5.6
Commercial		9.89	9.27	6.7
Industrial		26.93	27.32	−1.4
Other		3.09	2.90	6.6
Fuel Consumption	Dec.			
Coal—million tons		16.91	15.47	9.3
Oil—million barrels		9.55	9.37	1.9
Gas—billion cu ft		114.37	113.66	0.6
Net Income Class A & B Co's—$ million	Dec.	180.14	161.69	11.4
Residential Customers—millions	12 mos.	50.00	48.97	2.1
Revenue per kwhr	ended	2.47¢	2.50¢	−1.2
Avg kwhr per customer	Dec. 31	3,790	3,585	5.7
Avg annual bill		$93.61	$89.63	4.4

Business Statistics

Indexes:				
FRB Industrial Production (1957 = 100)	Jan.	102	111	−8.1
ENR Construction Cost (1949 = 100)	Mar.	174.9	170.5	2.6
BLS Cost-of-living (1947–49 = 100)	Jan.	127.4	125.4	1.6
New Orders for Machinery (1950 = 100)	Jan.	165	171	−3.5
NEMA Sales				
Insulation materials	Dec.	130	154	−15.6
Electric appliances, est.		77.0	91.3	−15.7
GNP—annual rate—$ billion	3rd qtr	492.7	480.0	2.6

Significant Changes: Industrial sales down from a year ago. The figure was positive from August through November in spite of recession because of comparison with steel strike levels of 1959.

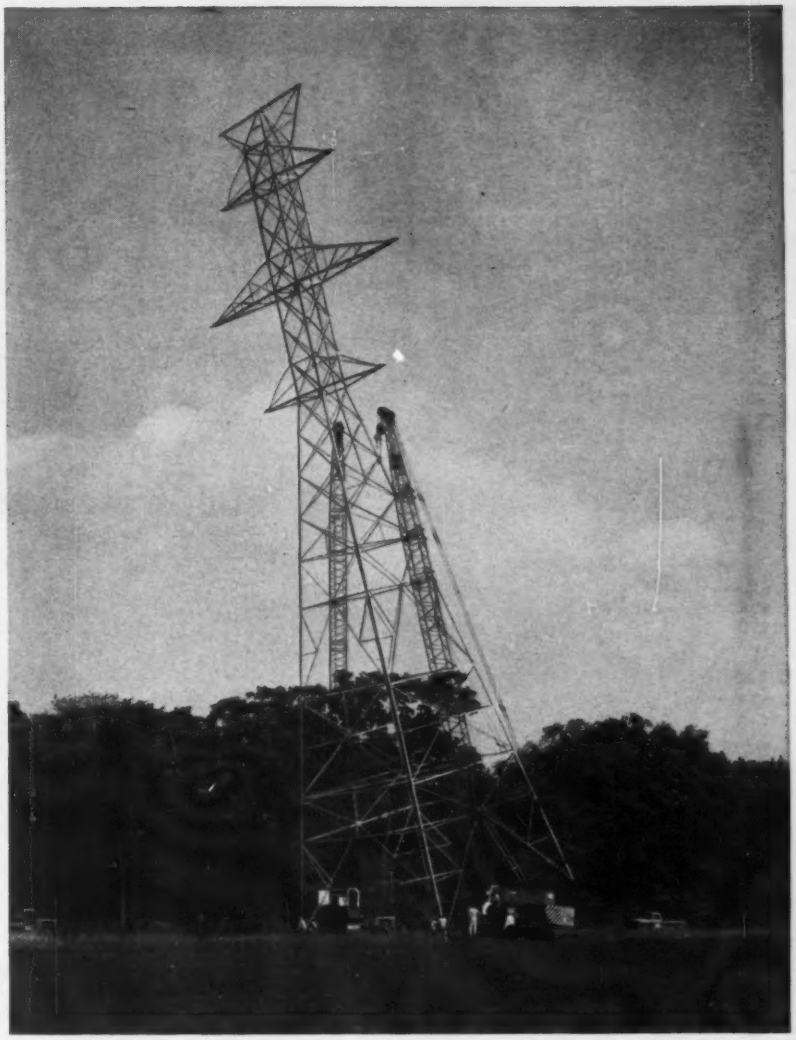
Building WEPCO's "Highway" for Oak Creek Power

Steel towers used for 230-kv line to transmit output of Oak Creek's two new 275-mw generating units

Wisconsin Electric Power Company will boost its generating capacity in 1961 with the installation of a second giant, 275-mw cross-compound turbine generator at Oak Creek plant, on the shore of Lake Michigan about 15 miles south of the city center. The fifth unit at this plant, also 275-mw, began operation at the end of 1959.

Additions to the generating capacity at Oak Creek require the construction of a number of new circuits, one of which is the Oak Creek-to-Arcadian Substation line shown here under construction.

189 STEEL TOWERS . . . The line required 140 suspension, 47 angle, and two transposition towers, all supplied by Bethlehem Steel. The double-circuit structures vary in height between 130 and 180 feet and the average span length is 885 feet. All but the extremely large towers were erected by the up-ending method, which this utility favors.



Two crawler cranes double-team a lofty tower into position on its footings. The structure was first assembled on the ground.

Steel *for Strength . . . Economy . . . Versatility*

FABRICATED AT LEETSDALE . . . The steel towers were designed by Bethlehem, and detailed, fabricated, and galvanized at our Leetsdale tower shop, near Pittsburgh, Pa. If you are in the market for transmission towers and switchyard structures, remember that Bethlehem also operates fully equipped shops at South San Francisco and Seattle, to fill requirements west of the Rockies.

BETHLEHEM PRODUCTS for electric utilities include transmission towers and substation structures, ACSR core wire, coated strand, and virtually all steel products required for the construction of generating stations: structural steel, fasteners, piling, concrete reinforcing bars, and others. Bethlehem Steel is one of the nation's largest fabricators and erectors of power plants.

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BETHLEHEM STEEL

Precision

How Precision's exclusive qualities make multiple lighting control **99% fail-proof**

This engineer uses a jeweler's glass for his final inspection of every Precision photocontrol. Other Precision engineers use ageing chambers, comparators, endurance and hardness testers, oscilloscopes and weatherometers — plus devices originated by Precision for "breakdown" testing of lighting controls — to insure Precision performance at sixteen separate quality control points in our labs.

It is their attention to perfection that makes Precision photocontrols so nearly fail-proof that Precision-equipped multiple lighting systems need only 1% controls replacement in any given year. That is a fact, proved on the lines of major utilities a half million times every day. This perfection results from built-in Precision distinctions that set this control apart from all complex, old-style photocontrols.

Superior materials

Precision uses the industry's largest gold electrode cadmium sulfide cell and gives it total area exposure since both shading and shielding reduce the efficiency of any photocell. Precision makes and uses the only bimetal switch metallurgically-balanced specifically for lighting control. Then Precision adds special pre-fabrication techniques possible only in the world's largest laboratory devoted entirely to multiple lighting controls: measured-atmosphere ageing, heat treating, electronic-measurement of switch calibration accuracy. No other company can invest so much skill in **every** control.

Advanced engineering

Precision gave multiple lighting its "reliability breakthrough" five years ago and continues to lead the field with the only control designed, engineered and developed for one purpose — precise regulation of artificial lighting twice each day through rigid and unfailing response to natural light levels. Other controls are adaptations from obsolete tube-type controls containing up to 18 fragile components. Precision controls have only 2 components. Precision engineering eliminates all inherent fail-out hazards of capacitors, contact balances, magnetic relays, rectifiers, sensing flexible leads, tubes and printed circuits.

Laboratory production

Precision controls are built entirely by technicians, to insure the human-eye responsiveness with all-weather durability demanded in multiple lighting control. Major utilities in every geographical region of North America have contributed field-engineering recommendations during the past four years that have made these controls virtually fail-proof on 400,000 installations. They will utilize the expanded production facilities of Precision to put thousands more of these perfected controls on the line in 1961.

Field service engineers

Because Precision controls are used on more different installations than any other tubeless control, our field engineering representatives have unique experience in automatic control of multiple systems under all conditions. They are your ablest advisors in matching this perfected control to your most specific demands of weather, surge, lightning or light levels.

Write or wire today for data and quotations.

PRECISION MULTIPLE CONTROLS, INC. • Ridgewood, New Jersey

The difference between night and day

Future Opportunities Good for Residential and Commercial Sales

R. R. CAHAL JR, Utility Marketing Consultant, Ebasco Services, Inc, New York, N. Y.

What are the principal utility sales trends and the major forces which will shape utility sales in the coming years?

First let's take a look at the residential market (Chart 1). Last year residential sales accounted for 41% of total electric utility revenues and 57% of total gas utility revenues. From this standpoint it is the largest market, and in the last ten years it has been the fastest growing one. Growth rates for residential sales —both electricity and gas—have been persistent and consistent.

These satisfying trends are, of course, a result of two basic forces: More households as customers and more use of electric and gas service by each of these customers. In 1961, the average residential electric customer will use more than 4,000 kwhr and the average residential gas customer will use 1,095 therms. These figures compare with 2,004 kwhr and 703 therms just ten years ago.

The annual percentage increase in average electric use has declined in the last several years, but it has shown signs of stabilizing at about 6.5%. This is not enough for a doubling every-ten-years' rate, but if it continues, average use per customer will reach 7,000 kwhr by 1970. This has become sort of a self-appointed goal for the industry.

Can the industry maintain this pace and reach this goal? It is quite possible; in fact, it is probable. But it isn't guaranteed!

(Chart 2) This chart presents an idea of the composition of average electric use 11 years ago, last year, and a possibility for ten years hence. The three basic loads—ranges, refrigerators, water heaters — increased their contributions to average use between 1950 and 1960, but that contribution did not keep pace with average use itself, and consequently their share of average kwhr consumption has diminished slightly.

The most significant change in the composition of average consumption between 1950 and 1960 is the emergence of heating and cooling as a major load. In 1950, comfort conditioning accounted for about 2% of average use; and about 11% in 1960. Television also grew in importance—from about 3% in 1950 to about 8% of total average use in 1960.

Now look at 1970. The "goal" of 7,000 kwhr can be reached if the basic major appliances continue to increase in saturation and if "comfort conditioning electrically" lives up to the promise shown in the last few years. We figure that when

(*Continued on page* 96)

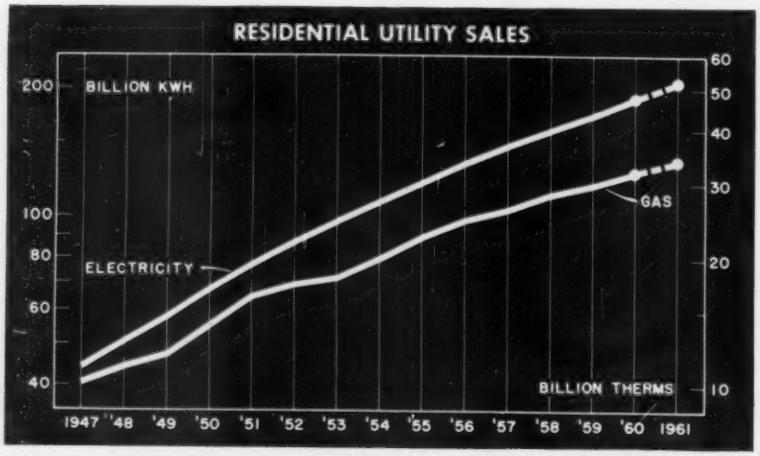

FIG 1—Residential sales accounted for 41% of 1960 electric revenues

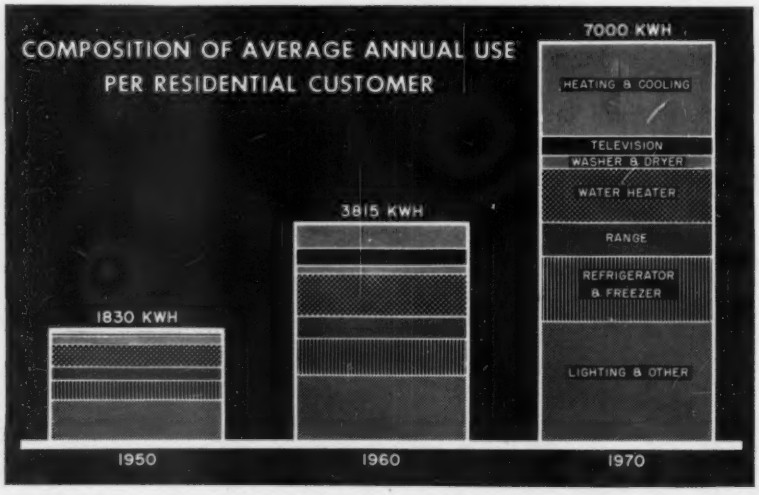

FIG 2—Heating and cooling loads show significant change in past ten years

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609

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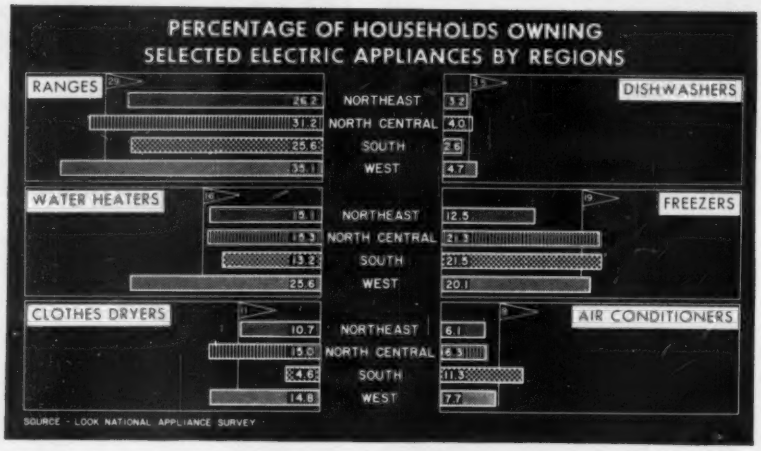


FIG 3—Figures in flags show national ownership for various appliances

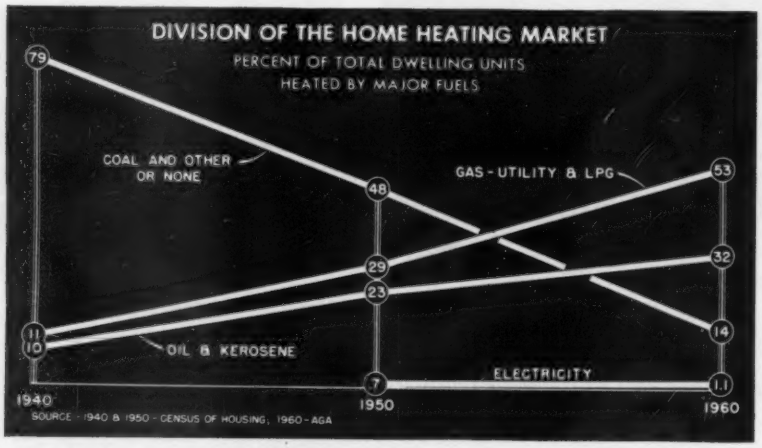


FIG 4—Sales growth will depend largely on heating and cooling loads

7,000 kwhr a year is reached, heating and cooling loads will likely account for more than 20% of it. The composition of 1970 is based on:

1. A 50% saturation of combination refrigerators and a 30% saturation of freezers.

2. A 50% saturation of electric ranges, compared to 33% in 1960.

3. A 25% saturation of water heaters, compared to about 20% today.

4. A 7½% saturation of electrically heated homes, compared to 1½% today.

5. Twenty-five room air conditioners in every 100 dwelling units, compared to less than 15 today.

6. A 5% saturation of centrally air-conditioned homes compared to 1 plus % in 1960.

These are not predictions of what saturation will be in 1970, but merely an approximation of what it will take to make a 7,000 kwhr year. It may happen before 1970. Much depends on market factors and consumer acceptance in the intervening years.

(Chart 3) Here's the current saturation situation. This chart shows the percentage of households owning six major electric appliances nationally and for the four regions of the country. These figures are based on the National Appliance Survey sponsored by *Look* Magagine, a comprehensive study of appliance ownership. The figures shown here are for *ownership* rather than for saturation, because the *Look* study broke only the ownership figures down by region. Saturation figures are somewhat higher because of a number of renters having appliances furnished, but in most cases the difference in proportions of households owning an appliance and having it in the house are small.

For instance, according to *Look*, 29% of the households, own electric ranges. (The national ownership figure is shown in the flag.)

In an approximation of the composition of residential gas use 11 years ago compared with 1960 and nine years from now it is clear that gas for heating dominates residential consumption. This importance has increased in the last 11 years, and it will continue to do so in the next nine years. The composition for 1970 is based on the following trends:

1. About ⅔ of the nation's homes will be heated with gas, compared to about ½ today.

2. Some weight is given to gas air conditioning being able to capture a small share of the central air conditioning market by 1970.

3. About the same percentage of gas customers will cook with gas, but gas cooking's share of the total market will decline slightly; about the same percentage of gas customers will cook with gas.

4. Gas will improve its over-all position in water heating, especially among gas heating customers.

5. Gas will benefit from increased saturation of gas clothes dryers, and some acceptance of the refrigerator and incinerator.

The *Look* survey indicated that 63.5% of the households have a gas range in their home, but only 51% of the nation's households *own* a gas range. Percent ownership is higher in the South and North Central regions. The relatively low position in the Northeast probably is due to a higher proportion of rental dwellings in this area.

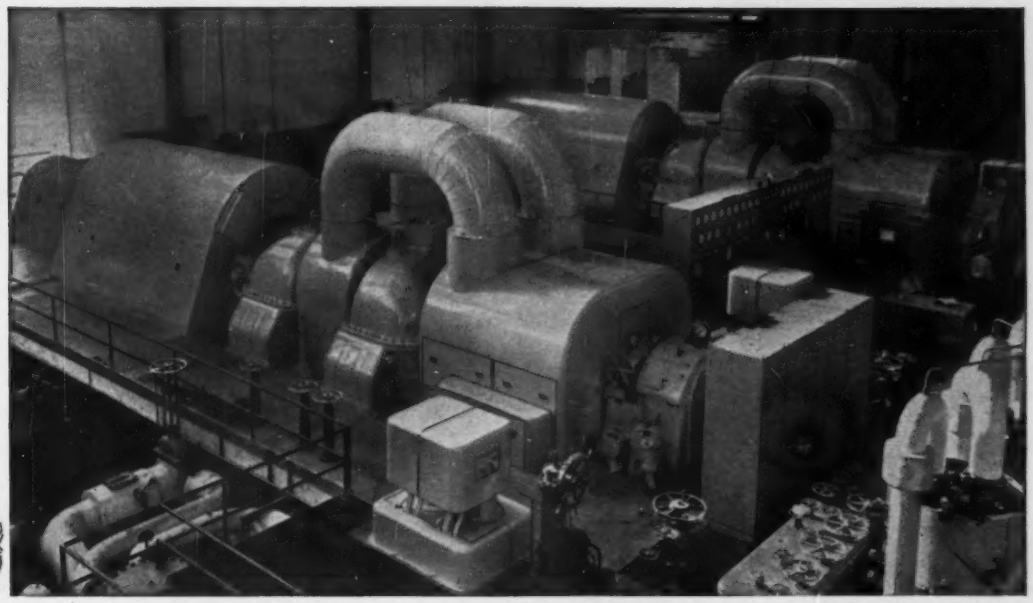
Saturation of gas water heaters is 50.1%, but only 35% of the nation's households *own* a gas water heater. The North Central region leads in percent ownership of this appliance.

Ownership of gas refrigerators was 3.5%.

Ownership of gas clothes dryers was 5%. Saturation in the North Central region is more than twice that of any other section.

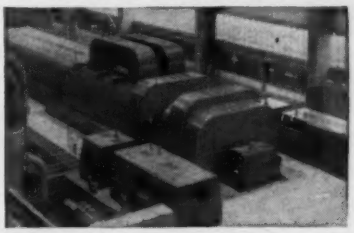
(Chart 4) We have indicated that sales growth for both services will depend largely on heating and cooling loads.

(*Continued on page* 99)



IN CANADA *Two 'ENGLISH ELECTRIC' 45,000 kW MCR hydrogen cooled 60-cycle turbo-alternator sets of the Nova Scotia Light and Power Co. Ltd., Halifax.*

it started in grandpa's days..



IN GREAT BRITAIN *One of five 'ENGLISH ELECTRIC' 200 MW turbo-alternator sets in the turbine room of the High Marnham Power Station of the Central Electricity Generating Board.*

Even in the early 1900's, when electricity had yet to establish itself for lighting our grandparents' homes and streets, 'ENGLISH ELECTRIC' was already experienced in the manufacture of steam turbines and alternators.

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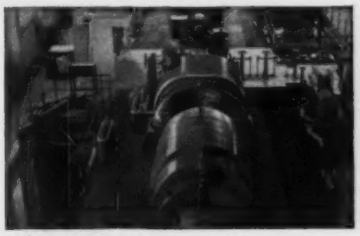

IN MALAYA *Two 'ENGLISH ELECTRIC' 10,000 kW, 3,000 r.p.m. turbo-alternator sets in Malacca Power Station, of the Malayan Central Electricity Board.*

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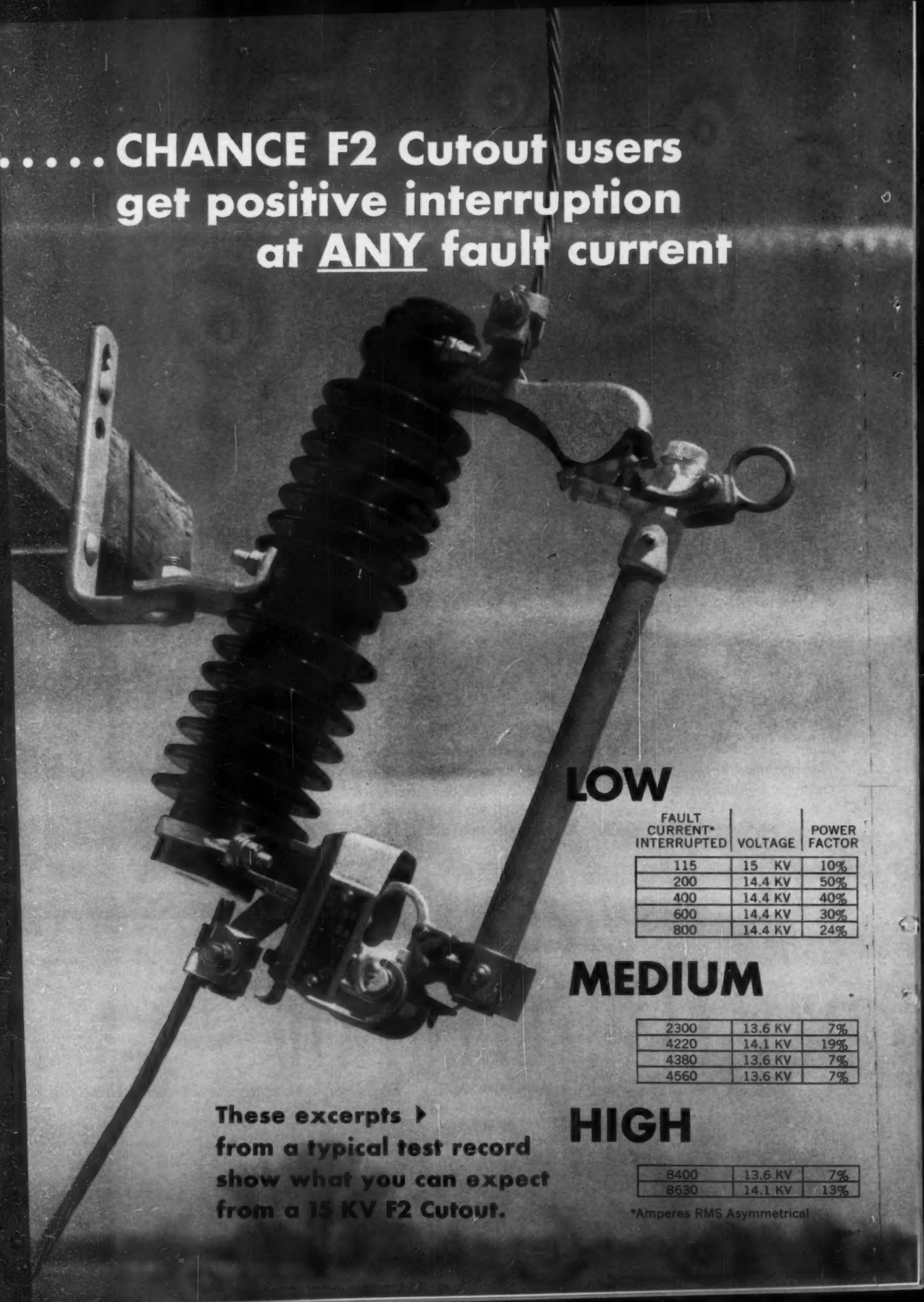


LOW

FAULT CURRENT* INTERRUPTED	VOLTAGE	POWER FACTOR
115	15 KV	10%
200	14.4 KV	50%
400	14.4 KV	40%
600	14.4 KV	30%
800	14.4 KV	24%

MEDIUM

2300	13.6 KV	7%
4220	14.1 KV	19%
4380	13.6 KV	7%
4560	13.6 KV	7%

HIGH

8400	13.6 KV	7%
8630	14.1 KV	13%

These excerpts ▸ from a typical test record show what you can expect from a 15 KV F2 Cutout.

*Amperes RMS Asymmetrical

Future Opportunities Good (*Continued from page* 96)

This chart shows the division of the house-heating market at ten-year intervals since 1940. Gas now heats more dwelling units than all other fuels combined. Electricity is just beginning to make a mark on the national heating market.

We believe that these trend lines will continue in the same general direction for the next several years. Gas, electricity, and oil will increase their shares of the total house heating market, while solid fuels dwindle to near nothing. In the meantime, of course, the "big three" will continue to make inroads on each other, as they have in the past. These trend lines just show the net result.

When we try to assess the future of appliances, heating and air conditioning, we see four principal factors which will be decisive:

1. The size of the market.
2. The quality of the market.
3. Competitive position.
4. Selling effort.

There can be little doubt that the growing population will expand the size of the market. By 1970 probably 31 million people will be added to the population. This will net another 10 million households and we expect that during the next nine years more than 15 million new houses will be built.

A definite rise has taken place in the last 14 years in per capita disposable income. The trend is expected to follow in the future.

In 1947 only 27% of the nation's families had incomes over $6,000—expressed in 1959 dollars. By 1959 this proportion had risen to 42%.

These higher incomes have real impact on the market's ability to "absorb" appliances. For example, according to *Life* Magazine's "Study of Consumer Expenditures" of a few years ago, households with incomes of $7,000 or more spent 63% more than the average household on appliances, 21% more than the average on radios, phonographs, and television and 38% more on home heating and utilities. The college-educated household spent 44% more than the average on appliances, 21% more on radios, phonographs and television, and 24% more on home heating.

Another factor which will influence the growth of residential electric and gas sales this year is competition. The current phase of our economy has been described as "competitive prosperity." The term is also quite descriptive of the residential utility sales picture in the coming years. There is so much opportunity and room for growth that both electric and gas sales are bound to prosper, if they are properly promoted. But competition will become increasingly severe between the two.

Commercial Sales Not as Rapid

Now turn to the commercial market. In 1960, commercial sales accounted for about 25% of total electric utility revenues, 12½% of total gas revenues. Over the past ten years, sales to commercial customers have grown substantially, but they have not grown quite as rapidly as residential or industrial.

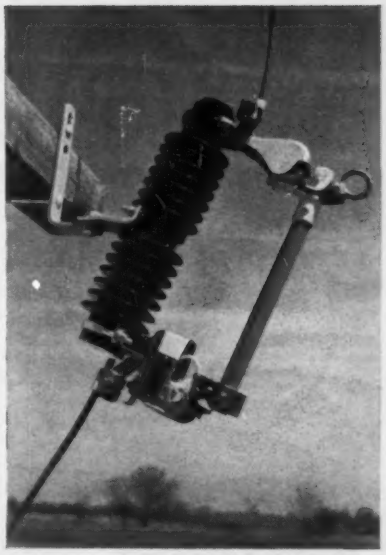
The increase in number of commercial electric customers has not kept pace with the increase in number of residential customers, and the ratio of commercial customers to residential has declined from 14.6% in 1950 to about 12.8% last year. This probably is due to the trend toward larger establishments which means that fewer businesses can serve the same population. This trend, however, has had little apparent effect on the growth rate of commercial gas customers. They've grown as fast as, if not faster than, residential. For practical purposes, the ratio of commercial to residential has remained virtually constant at about 8%.

Average use per commercial customer has grown steadily through the years. We predict that this year electric use per commercial customer will pass 19,000 kwhr and that average gas use will reach 3,830 therms.

What market factors will determine the trend of commercial sales in the years ahead? One point of strength will be a continued increase in commercial "population" to serve the growing national population.

In spite of continual increases in the volume of commercial and institutional construction of all kinds, it is evident that the country's needs have not been fully satisfied. Moreover, slum clearances, urban redevelopment, suburban growth and other changes in the face of Amer-

(*Continued on page* 100)



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- EXPENDABLE CAP assures wide-range operation on *any* fault. A small disc in the cap is ripped off on high fault currents, permitting the double-venting required to hold shock and strain to a minimum. On low and medium faults, the disc stays in place. By keeping the gases under the cap, the F2 single-vents to give protection against these lower faults.
- FUSE LINK EJECTOR makes doubly sure the cutout operates on low fault currents. Teamed with a small-bore fusetube, it assures low fault current interruption. Vitally important to load-break operation.
- POSITIVE LATCH holds fuseholder with a "bulldog grip"... keeps the cutout from opening under vibration or impact. Even if the fuselink is not installed tightly (or slips or stretches after installation), the fuseholder will not drop out. The latch cannot be welded shut because it is not a primary current-carrying element.
- ALL-BRONZE SLEET HOODS at both ends completely protect vital contact areas under all weather conditions. These all-bronze sleet hoods, and extensive use of copper alloy in the F2, guarantee trouble-free, peak performance, even in the most contaminated atmosphere.

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E-1

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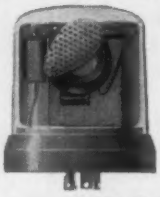
The Facts of Life in Street Light Control

1. Big killer of photo controls is transient voltage surges in secondaries which are below the spark-over of lightning arresters.

2. LUMATROL MARK I uses Varistors in conjunction with a secondary lightning arrester to withstand ALL transients up through the capabilities of the secondary arrester.

AUTOMATIC... COMPACT... LIGHTWEIGHT... SIMPLE... ...AND COMPLETELY RELIABLE!



WRITE FOR BULLETIN 91a.

MICRO BALANCING, INC.
GARDEN CITY PARK, N.Y.
In Canada: J. R. KEARNEY CORP.
Box 270, Guelph, Ont.

(*Continued from page* 99)

ica create a much greater market opportunity than numerical growth might suggest.

In 1960, for example, more money was invested in construction of offices, stores, restaurants, and churches than ever before. Educational building is now on a high plateau, and we can look forward to expanded building by colleges in the coming years. Hospital building is at a new high. Incidentally the recent resurgence of hospital building is traceable almost altogether to a boom in private hospitals—or at least hospitals not built by government agencies.

A second market factor which offers potential for growth is the drive for modern commercial and institutional establishments, not only by designing new buildings to exacting standards but also through modernizing existing structures.

The food service field promises to be one of the most interesting markets in the coming years. It is not only a very important market for electric and gas service, but it is undergoing some fundamental changes in concepts and practices. Over 40,000 ranges were sold in 1959, more units than any other piece of equipment. Then came griddles and fry kettles.

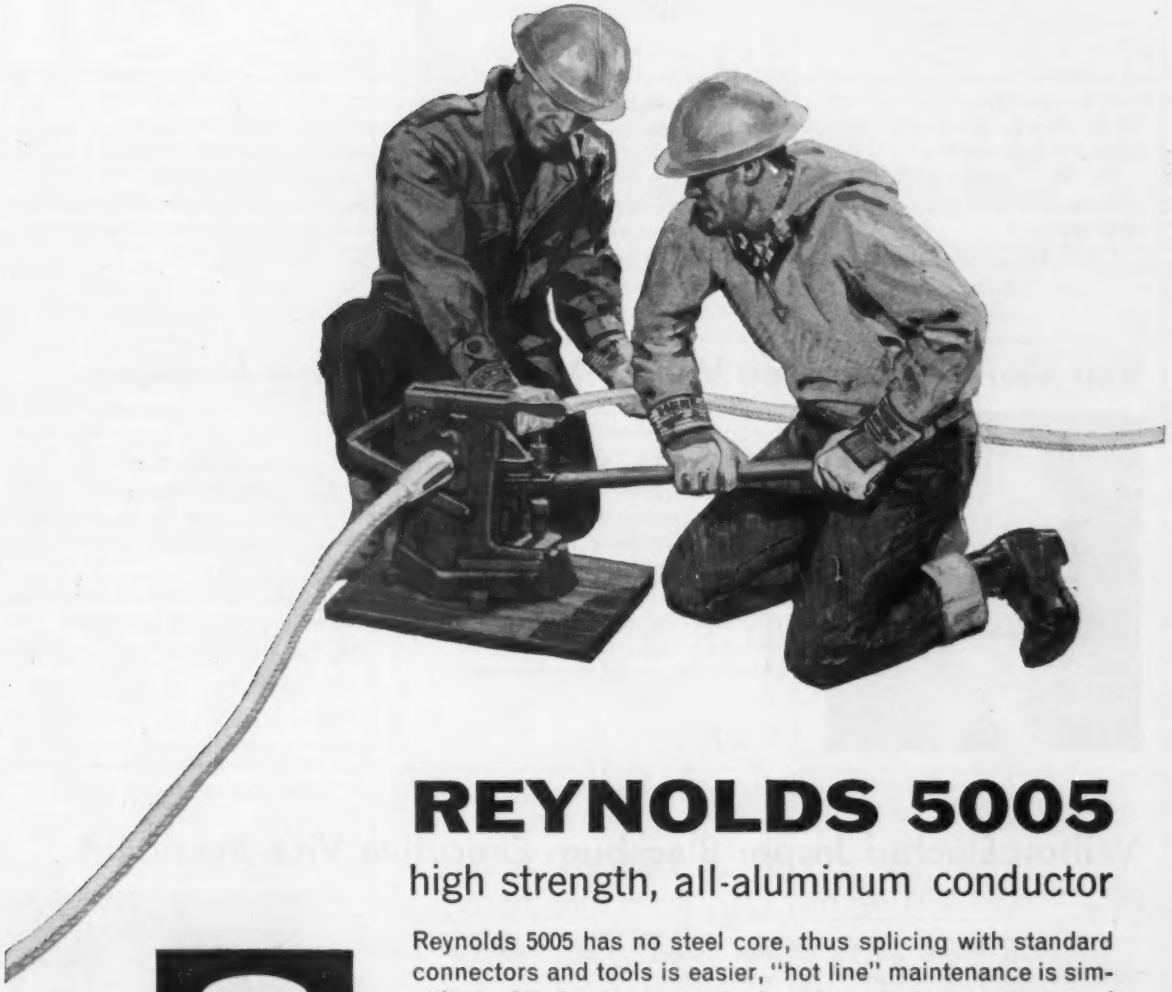
Electric models outsold their competition only in the case of fry kettles. In other types of equipment, gas and other fuels far outsold electric.

We are not sure how long this kind of profile will last. Some manufacturers believe it won't be long until the commercial range is supplanted completely by equipment tailored to do a special kind of job.

Pre-prepared foods are also causing a new look at conventional cooking equipment. For, example, some types of food service establishments have found that the use of frozen-prepared foods, packed in individual servings, provides, better quality and cost control. This trend will likely create the need for new equipment.

In conclusion: There is less built-in growth in the future for utility sales than at any other time since World War II. But at the same time the realizable potential is greater than ever before. This puts it squarely up to the fourth factor: selling effort.

EASY TO SPLICE



REYNOLDS 5005

high strength, all-aluminum conductor

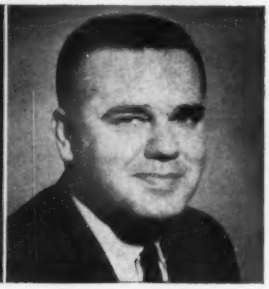
Reynolds 5005 has no steel core, thus splicing with standard connectors and tools is easier, "hot line" maintenance is simplified. All-aluminum conductor also eliminates chance of galvanic corrosion. Light weight lowers installation costs—it's easier to string, easier to handle. And Reynolds 5005 costs less than any other conductor with comparable properties. Minimum guaranteed conductivity 53.5%. Complete data available from your nearest Reynolds branch office, Reynolds Electrical Distributor, or *Reynolds Metals Company, P.O. Box 2346-EL, Richmond 18, Virginia.*

Watch Reynolds TV show "Harrigan & Son", Fridays; also "All Star Golf" Saturdays—ABC-TV

Texas Utility Names Three Executives

COOK

BYRON



AUSTIN

Texas Power & Light Co has elected Lee E. Cook and L. A. Byron as executive vice presidents and T. L. Austin Jr as vice president. Byron was also named a director.

W. W. Lynch, president, general manager, and chairman, will now have the title president and board chairman.

Cook has been with TP&L since 1920. A vice president and general manager since 1949, Cook is also a director.

Byron, who came to TP&L in 1953 from a post as executive vice president of Missouri Utilities Co, was most recently vice president-operations.

Promoted from superintendent of power, Austin has been with TP&L two years. He was previously vice president of Industrial Generating Co.

Van Mol Is Tennessee Valley Authority General Manager

◀ LOUIS J. VAN MOL

Louis J. Van Mol has been promoted to general manager of Tennessee Valley Authority, succeeding Aubrey J. Wagner who became a member of TVA's board of directors. Wagner filled the spot vacated by Brooks Hays who was appointed assistant secretary of State in the Kennedy Administration.

Van Mol has been with TVA since 1936. He held posts of increasing responsibility and, in 1952, was named assistant director of personnel. He became chief budget officer in 1954, and was assistant general manager prior to his recent appointment.

Wilton Elected Jasper Blackburn Executive Vice President

William E. Wilton has been elected executive vice president of Jasper Blackburn Corp, St. Louis.

Wilton had been vice president in charge of engineering and manufacturing since 1953. He joined the company in 1939 and was appointed works manager in 1946.

WILLIAM E. WILTON ▶

(*More News About People on page* 104)

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Field and Laboratory Testing of Solid and Liquid
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tem Electrical Operating Characteristics and
Problems.

Office and Laboratory: Doble Park
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bution Systems—Power Surveys, Reports & Con-
tracts—Industrial, Transportation & Communica-
tion Facilities—Water & Waste Treatment Works.

Pennsylvania Station — New York 1, N. Y.

The Consulting Engineer

"By reason of special training, wide experience and tested ability, coupled with professional integrity the consulting engineer brings to his client detached engineering and economic advice that rises above local limitations and encompasses the availability of all modern developments in the fields where he practices as an expert. His services, which do not replace but supplement and broaden those of regularly employed personnel, are justified on the ground that he saves his client more than he costs him."

GILBERT ASSOCIATES, INC.

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Erection and Maintainance of
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Michigan Theatre Building — Ann Arbor, Michigan
NOrmandy 8-7778

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Industrial Plants • Process

1333 North Second Street — Abilene, Texas
214 Meadows Building — Dallas, Texas

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Construction and Maintenance

Transmission - Distribution
Electric and Telephone Lines
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505 York Road — Jenkintown, Pa.

VERNON GRAPHICS, INC.

Mount Vernon, N. Y.
MO 4-7117

VERNON GRAPHICS OF PA. INC.

Norristown, Pa.
Broadway 9-3000

CONSULTING AND SERVICING UTILITIES
ON MAPS, RECORDS AND FIELD INVENTORY

PERSONAL BRIEFS

H. O. Sprinkle, assistant to the executive vice president of Monongahela Power Co, has retired.

Tampa Electric Co has made the following appointments: **G. D. Leach** as commercial sales manager, sales department; **M. D. Wilcox** as supervisor-trouble department, distribution department; **F. J. McClendon** as assistant garage supervisor, garage; **W. E. Smith** as employment supervisor, employee relations department; **J. W. McManus,** claims assistant, employee relations department; **G. D. Gentry** as training assistant, employee relations department; **L. A. Bohannon** as service engineer, Pasco County division, Dade City; **P. S. Chamberlain** as administrative assistant, administrative department; **H. C. Coleman Jr** as division right-of-way agent, Plant City division; **J. N. Thompson** as field engineer, Plant City division; **R. L. Meeks** as stores coordinator, stores department; and **C. A. Muench Jr** as engineer-communications, engineering department.

Harold W. Collins has retired as assistant to the system development manager, and **W. Frederic Wetmore** as general engineering department director, both at Detroit Edison Co.

James V. Barker has been promoted to superintendent of construction for Virginia Electric & Power Co, succeeding **Ivan Buys** who retired.

The president of Pennsylvania Electric Co, **Louis H. Roddis Jr,** has been appointed to the board of Pennsylvania Industrial Development Authority.

Arkansas Power & Light Co has made **Edward P. Fitzgerald** distribution superintendent for Little Rock; **Roy H. Hogan Jr,** assistant to the Little Rock office manager; and **Everett G. Oates,** executive assistant in the general office, succeeding **W. Mills Murphey** who became corporate service department manager.

Murrel C. Rogers has been elected assistant secretary of Oklahoma Gas & Electric Co.

Oklahoma Gas & Electric Co has promoted **Tom M. Eubanks** to Arkansas division superintendent; **Everette Bradshaw** to Arkansas division line supervisor; **Ralph V. Brown** to Wewoka district manager; and **Sam E. Tyo Jr** to Seminole district accountant.

Connecticut Light & Power Co has promoted **A. Louis Bisio** to assistant real estate engineer.

Philco Corp has appointed **Harold W. Schaefer** vice president-director of engineering for the consumer products division.

I-T-E Circuit Breaker Co has promoted **George M. DeVito** to assistant to the manager-construction marketing.

Dr Howard Reiss has been appointed associate director of the research department at Atomics International, division of North American Aviation, Inc. **Earl D. Needham** became material director for the division.

Control Data Corp has named **Curtis W. Fritze** systems specialist.

Copperweld Steel Co has named **Ralph D. Pyle** chief electrical engineer, wire and cable division.

Raytheon Co has formed a company-wide government marketing function, two new operating divisions, and realigned the responsibilities of a third division. Vice President **Glenn R. Lord** heads the new government marketing function. Vice President **T. C. Wisenbaker** heads the aero/weapons division; Vice President **Thomas L. Phillips,** the missile and space division. The reorganized equipment division is headed by Vice President **Fritz A. Gross.**

Lester Ziffren has become director of public relations for Kennecott Copper Corp.

Radio Corp of America has named **Frank P. Barnes** manager, communications products department; **Herman R. Henken,** advertising and sales promotion manager, electronic data processing division; and **Harold N. Morris,** engineering manager for the computer systems plant at Palm Beach Gardens, Fla. Also, **John J. Kramer** has been named manager, industry group sales, for the commercial sales department of electronic data processing division. Radio Corp of America has boosted **Fred G. Wenger** to manager, production planning, electronic data processing division.

Simplex Wire & Cable Co has appointed **Harry G. Wilson** as the manager of advertising and market development; **William Courtney** as supervisor of advertising; and **William A. Whittemore** as manager of commercial marketing.

Eugene A. Christian Jr has been named chief engineer of Sequoia Wire & Cable Co, subsidiary of Anaconda Wire & Cable Co.

The following people have retired: **W. F. Young,** executive vice president of G&W Electric Specialty Co; **W. F. Lent,** vice president of Cutler-Hammer; **Elton R. McCoy,** vice president of Joslyn Manufacturing & Supply Co; and **Ralph H. Earle,** manager of engineering development at McGraw-Edison Co's Line Material Industries.

OBITUARIES

Oliver T. Pulsifer, 62, vice president and treasurer, Suburban Electric Co. . . **William O. Kyte,** 49, advertising and sales promotion manager, apparatus sales division of Pacific Southwest district, General Electric Co. . . **Harry Hand Haeberly,** 60, sales representative, New York office of Jackson & Moreland. . . **Harold Moore Sawyer,** 69, retired sales vice president, American Gas & Electric Co (now American Electric Power) . . . **L. F. Chambers,** 69, vice president and treasurer, Northern States Power Co . . . **Thomas H. Gibbon,** 64, east central region manager, Hydro-Electric Power Commission of Ontario . . . **Joseph D. Wood,** 86, consulting electrical engineer, I-T-E Circuit Breaker Co and former president, Roller-Smith.

CLASSIFIED SEARCHLIGHT SECTION ADVERTISING

EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

DISPLAYED RATE:

EMPLOYMENT OPPORTUNITIES: $25.50 per inch. Subject to Agency Commission.
EQUIPMENT & BUSINESS OPPORTUNITIES: $16.85 per inch for all advertising appearing on other than a contract basis. Not subject to Agency Commission.
AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page.
EQUIPMENT WANTED or FOR SALE ADVERTISEMENTS acceptable only in Displayed Style.

UNDISPLAYED RATE:

$1.80 a line, minimum 3 lines. To figure advance payment count 5 average words as a line.

PROPOSALS, $1.80 a line an insertion.
BOX NUMBERS count as one line additional in undisplayed ads.

DISCOUNT OF 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

Send New Advertisements to Classified Advertising Div. of Electrical World, P. O. Box 12, N. Y. 36, N. Y.

POSITIONS VACANT

Electrical Engineer—Excellent opportunity for graduate engineer to enter consulting field and grow with progressive Midwest concern. Board layout work—power, lighting, and control systems; calculations; and occasional field contacts. 3-5 years experience. Moving expenses paid. Send resume, including education, experience, and personal qualifications to P-6246, Electrical World.

Wanted—Graduate Electrical Engineer. Opportunity for a graduate Electrical Engineer to serve as Assistant Superintendent of a Municipal Electric Plant in Eastern Massachusetts. Experience in Transmission, Distribution and Plant Management desired. Please answer, giving education, experience and salary expected. Write to P-6290, Electrical World.

Applications are being accepted for the position of Supt. of Power by the Kaukauna Utilities Commission, Kaukauna Electrical & Water Depts. Utilities have 8,500 customers. Operate both Electrical & Water systems. State age, education, experience and references. Salary open. Mail applications to Wm. S. Ranquette, Manager, Kaukauna Electrical & Water Depts., Wisc.

Your Inquiries to Advertisers Will Have Special Value...

—for you—the advertiser—and the publisher, if you mention this publication. Advertisers value highly this evidence of the publication you read. Satisfied advertisers enable the publishers to secure more advertisers and—more advertisers mean more information on more products or better service—more value—to YOU.

TRANSFORMERS

3—2500 KVA G-E 69000—2400/4160Y
3—2500 KVA G-E 69000—7200/12470Y
4—2500 KVA W-H 34500—2400/4800
3—1500 KVA G-E 69000—2400/4160Y
3—1500 KVA G-E 69000—7200/12470Y
4—1000 KVA Mol 7200/12470Y—4160
3—1000 KVA G-E 34500-7200/12470Y
3— 500 KVA G-E 34500-2400/4160Y
3— 833 KVA W-H 43800—480
3— 333 KVA W-H 13200—2400/4160Y
3— 333 KVA GE 66000—2400/4160Y
3— 333 KVA Wag. 2400—120/240
1—1500/1875 KVA Mol. 3-Ph. 40,500—4800 F/C equipped
1—1500/1875 KVA Mol. 3-Ph. 34,500—2400 F/C equipped
1—1500/1875 KVA Mol. 3-Ph. 43800—2400/4160 F/C equipped

TRANSFORMERS WANTED

THE ELECTRIC SERVICE CO.
5316 Hetzel St.
Cincinnati 27, Ohio
47 Years' Dependable Service

DEPARTMENT OF THE INTERIOR, Bureau of Reclamation. Sealed bids (Invitation No. DS-5554) will be received at Denver, Colorado, until 2 p.m., Mountain Standard Time, April 25, 1961, for furnishing four 69-kv, 2,000-ampere, 3,500,000-kva; and two 14.4-kv, 600-ampere, 250,000-kva air-blast or oil type power circuit breakers for Spencer and Denison Substations, Missouri River Basin Project. Delivery is desired within 225 days. For particulars, address Bureau of Reclamation, Building 53, Denver Federal Center, Denver, Colorado. Floyd E. Dominy, Commissioner.

ADDRESS BOX NO. REPLIES TO: Box No.
Classified Adv. Div. of this publication.
Send to office nearest you.
NEW YORK 36: P. O. Box 12
CHICAGO 11: 520 N. Michigan Ave.
SAN FRANCISCO 11: 255 California St.

POSITIONS VACANT

Electrical Engineer familiar with electric power systems Permanent employment with opportunity for advancement in long-established consulting engineering firm. Write or call Stanley Engineering Company, Muscatine, Iowa.

Construction Supervision. Construction Engineer for inspection and supervisory work on electric power lines and substations. Opportunity for permanent employment and advancement with well-known consulting engineering firm. Send resume to P-6001, Electrical World.

MAINTENANCE OF ELECTRICAL DISTRIBUTION LINES

Re-Impregnation of Wood Poles in Service

A large international organization, which has a specialized and proven method of ground-line treating wood poles, desires to contact companies or persons to promote and execute this process throughout the U. S. A. with territorial franchise rights.

Applicants must have good existing contacts with electrical, telephone, and railroad companies; experience in the maintenance of electrical distribution lines preferred.

Promotion and execution of the work will be a complete company operation and office and works depot facilities should either be available or capable of being established.

Full technical training and assistance will be furnished.

Please send full details.

RW-6371, Electrical World
Class. Adv. Div., P.O. Box 12, N.Y. 36, N.Y.

A RARE OPPORTUNITY for

Either a **SALES ENGINEER** with Transmission and Distribution Line Construction experience, or an **ELECTRICAL LINE FOREMAN** or **SUPERINTENDENT** who thinks he can sell.

If you have the above qualifications and are willing to travel, a progressive West Coast manufacturer whose products are leaders in their field used by power and telephone companies has an opening in the Southwestern States which includes California, Arizona, Utah and Nevada, with headquarters in or about the Metropolitan area of Los Angeles. Salary, expenses and incentive bonus. Also many company benefits. If this interests you, write for an interview.

P-6319, Electrical World
255 California St., San Francisco 11, Calif.

PUBLIC UTILITY ENGINEER

Nationally known consulting firm has openings for engineering graduates with knowledge of public utility property. Work economic rather than design or construction. Age limit 45. Replies will be held in confidence.

P-6325, Electrical World
520 N. Michigan Ave., Chicago 11, Ill.

TRANSFORMERS FOR SALE

3—Uptégraff 500 KVA, 1/60, 2400 primary, 120/240 secondary, will reconnect 240/480, 4—2½% BN Taps, Pyronal or oil filled, O.I.S.C., Late Style, Guaranteed.

Zimmerman Electric Machinery Co.
3756 N. Broadway, P.O. Box 1746
Wichita 1, Kansas

Meetings Calendar

MARCH

Southeastern Electric Exchange — Annual Conference, Boca Raton Hotel, Boca Raton, March 27-29.

Symposium on Temperature—Sponsored by American Institute of Physics, Instrument Society of America, National Bureau of Standards, Columbus, March 27-31.

Electric Association of Kansas City—Fifth Biennial Electrical Supply Trade Show, Municipal Auditorium, Kansas City, Mo., March 28-30.

APRIL

The South Atlantic Wood Utility Pole Conference—Sponsored by the Wood Products Department of the School of Forestry, North Carolina State College, Raleigh, April 5-6.

Northwest Public Power Association — Annual Membership Meeting, Cascadian Hotel, Wenatchee, Washington, April 5-7.

American Institute of Electric Engineers—South East District Meeting, Jung Hotel, New Orleans, April 5-7; Rubber and Plastics Industries Conference, Sheraton Hotel, Akron, April 10-11; Extra High Voltage Cable Conference, Mark Twain Hotel, Elmira, April 11-13; Materials Handling Conference, Pick-Congress Hotel, Chicago, April 11-12; Electric Heating Conference, Sheraton-Lincoln Hotel, Indianapolis, April 11-12; Electric Welding, Commodore Hotel, New York City, April 17-21; Cement Industry Technical Conference, Sheraton-Cadillac Hotel, Detroit, April 18-20; Great Lakes District Meeting, Hotel Pick-Nicollet, Minneapolis, April 19-21.

American Society of Mechanical Engineers—Management Engineering Conference, Statler Hilton Hotel, New York City, April 6-7; ASME Oil & Gas Power Conference & Exhibit, Jung Hotel, New Orleans, April 9-13.

Michigan Municipal Utilities Association—Spring Conference, Wenonah Hotel, Bay City, Michigan, April 6-7.

Pacific Coast Electrical Association—Engineering & Operating Conference, Ambassador Hotel, Los Angeles, April 6-7; Business Development Conference, Sheraton-Palace Hotel, San Francisco, April 17-18; Administrative Services Conference, Villa Hotel, San Mateo, April 27-28.

• **Missouri Valley Electric Association**—Engineering Conference, President Hotel & Municipal Auditorium, Kansas City, April 12-14.

• Additions this week.

Cooperation Urged on APPA (*Continued from page 58*)

mission system and the transmission system. Finally, substation transformers and synchronous condensers should be reviewed, said Boehr.

In an interesting illustration obviously using the Los Angeles power system at some point in time as an illustration, Boehr showed how losses are incurred at every point between power production plant and the customer's meter, but at varying magnitudes of importance:

250-mile transmission (from Hoover Dam)	6.26%
4.8-kv feeders	4.75%
Secondaries (including transformers)	4.50%
34.5-kv network	1.50%
138-kv network	1.47%
34.5-kv/4.8-kv substations	0.82%
138-kv/34.5-kv substations	0.66%
Synchronous condensers	0.53%
Steam plant step-up transformers	0.48%

Since high losses occur on practically all systems, it is essential that the man with power of decision be convinced that these losses may be profitably reduced, stated Boehr. He suggested that the idea be sold by pointing out:

- Savings and investment
- Lower operating expense
- Improvement in voltage
- Increase in energy sales
- Low cost of reducing losses.

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CLASSIFIED ADVERTISING
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EQUIPMENT
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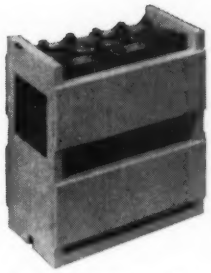
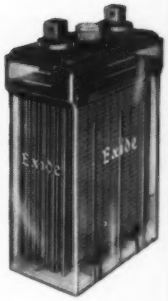
For Sale 105

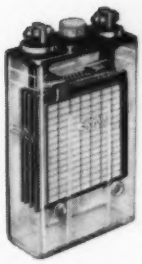
MATCH BATTERY POWER TO YOUR NEEDS AND SAVE MONEY



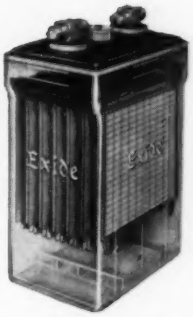
Low-maintenance pocket positive nickel-cadmium



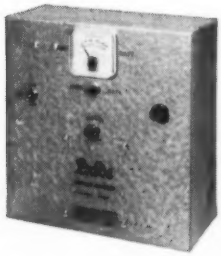
New 20-year Exide-Ironclad tubular with Silvium*



Flat plate Tytex with Silvium or calcium



Long life Exide-Manchex, Planté type, with Silvium



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*Silvium is Exide's patented corrosion-resistant grid alloy

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